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AN ILLUSTRATED REVIEW OF PROGRESS IN
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WITH MOTOR TRAFFIC SECTION.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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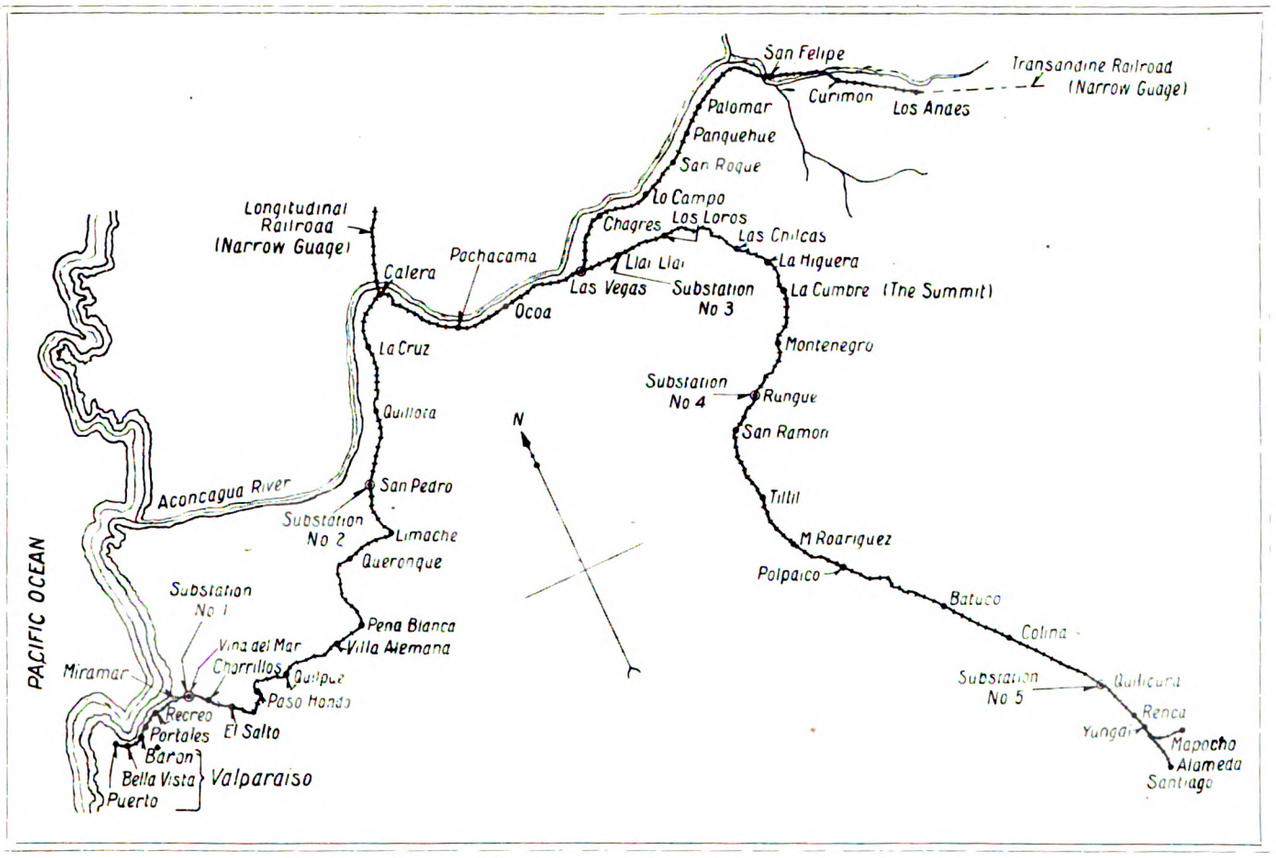
ELECTRIFICATION OF CHILIAN STATE RAILWAYS.

An initial contract provides for complete electrification of first zone, and includes 144 miles, 39 locomotives, and five sub-stations.

The Chilian Government has decided to electrify the steam railways. In spite of competition from European firms, the contract has recently been placed with the Westinghouse International Electric Company, through their South American representatives, Errazuriz Simpson and Company. This electrification is by far the most important railway electrification undertaken in 1921, and it is said to be the largest and most comprehensive single order for electric railway equipment ever received.



Outline Map Showing First Zone of Chilian State Railways to be Electrified.

Chile, which has an area of 290,000 square miles, and a population of 4,000,000 is a long, narrow country located between the Andes mountains and the Pacific Ocean, on the West Coast of South America. It is 2,629 miles long north to south, or more than four times the distance from London to Inverness, and varies from 100 to 250 miles in width. The extreme length of the country results in a variety of climatic conditions. However, in the section to be electrified at present, the variation between maximum and minimum temperatures conforms to normal conditions existing in the temperate zones, the maximum temperature in the shade in the summer being from 100 to 110 deg. F., and in the sun as high as 130 to 140 deg. F., while in the winter the temperature goes as low as 20 to 25 deg. F. The rainfall in this district is relatively small. In the central and southern sections the Andes receive a heavy snowfall, making extensive water power available.

The chief products of Chile are minerals, agricultural

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products, live stock, and lumber. Many of these products are exported and carried north over the railway. In return, coal, merchandise, machinery, and food products are imported, and form the bulk of the southward railroad movement. In Chile the nitrate deposits in the north rank first among the mineral deposits, and supply 75 per cent. of the exports. In 1913, 60,000,000 quintals were exported. Coal deposits rank second to those of nitrates, but in spite of this fact there is not enough coal to supply the country, and considerable coal is imported. The

Santiago Station of Chilian State Railways which will be Electrified.

present output of coal in Chile is 1,800,000 tons annually, while the consumption is about 2,700,000 tons, the railroads using 550,000 tons. Copper is also a very important mineral deposit, between 4 and 5 per cent. of the world's supply coming from Chile. Iron, sulphur, and gold are also mined. Other industries in Chile are farming and some fishing. The variety of climate permits the growth of a great diversity of food plants, among which are tropical fruits, vegetables, and cereals, including wheat, barley, oats, rye, corn, beans, and peas. In import trade to Chile the United States now ranks first and Great Britain second.

The railways of Chile aggregate 5,200 miles, of which about 30 per cent. (mainly for mining and industrial enterprises) is privately owned. The remainder of the mileage is divided into two general classes, the broad gauge lines and the narrow gauge lines. The former extend south from Valparaiso by way of Santiago to Paerto Montt, with numerous branches, while the latter comprise most of the northern roads, with a few branch lines in the south.

The conditions that arose during the recent world war brought very forcefully to the attention of the railroad management the necessity for electrifying the broad gauge lines, especially the Valparaiso-Santiago line with the Los Andes branch, where traffic was rapidly approaching the track capacity. In addition, fuel costs were excessive, while the almost limitless water power was going to waste.

In 1918 a Commission was appointed to study the problem of electrifying the broad gauge lines. This Commission, consisting of Rafel S. Edwards and Ricardo P. Solar, made a careful analysis of electrification all over the world. As a result of the possible economies shown in the report of this Commission, it was decided to electrify immediately the broad gauge lines, beginning with the Valparaiso-Santiago and Los Andes branches, or the first zone. A loan of 10,500,000 dollars for this purpose was authorised, and was heavily over-subscribed.

The awarding of the contract to the Westinghouse Company is a tribute to the exhaustive study made by its engineers in conjunction with those of the local firm, Errazuriz Simpson and Company. Every possible condition which could affect, or be affected by, the proposed electrification was considered, for the specifications called not only for locomotives to fit the traffic conditions but also for all sub-station, distribution, and overhead equipment, and for all construction work; in other words, for the complete electrification of the railroad.

Initial Electrification Scheme.

The initial electrification will include 116 miles from Valparaiso to Santiago, and 28 miles from Las Vegas to Los Andes, a total of 144 miles, as shown on the accompanying map. Los Andes is the terminus of the Transandine Railroad, a narrow gauge line, while the narrow gauge longitudinal railroad runs north from Calera, an important station on the line to be electrified. The maximum grade in this zone is 2·25 per cent., encountered in approaching La Cumbre (the Summit) from the west. The line contains a relatively large number of curves, the maximum being 10 deg. The track gauge is 5 ft. 6 in. There are six tunnels on the main line, the longest, the San Pedro, being 1,600 ft. in length. Three of the tunnels are located on the most severe grade approaching the Summit.

The 3,000-volt direct-current system was adopted as best suited to the conditions. Hydro-electric power will be generated at the Maitines Station of the Chilian Electric Tramway and Light Company, Limited. This station is already under construction, and will utilise the waters of the Rio Colorado. The station will contain three 8,125-KVA. Westinghouse generators, and will have an ultimate capacity of 30,000 KW. This power will be transmitted 37 miles to Santiago by twin circuit 110,000-volt transmission lines, and

A Thirteen-Coach Train on Chilian State Railways, Drawn by Two Steam Locomotives.

will be generated at 50 cycles, 3-phase. These transmission lines will be connected at Santiago with the system fed by the Florida hydro-electric station and the Mapocho steam station, both of which were constructed some years ago by the Germans, and were designed for 50 cycle 3-phase power. The total capacity of the three generating systems at present proposed will be, when completed, approximately 120,000 KW.

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The power supply will be distributed by five sub-stations designed to handle a train movement that is approximately 50 per cent. greater than that existing in 1917, with a further provision for tripling the 1917 traffic demands if necessary. Each station will initially contain two Westinghouse 2,000-KW. motor generator sets, each set consisting of a 2,800-H.P. driving motor, and two 1,000-KW. 1,500-volt generators connected in series. These sets will be designed to withstand a 200 per cent. overload for five minutes without injury, and as an additional safeguard the flash suppressor which the Westinghouse Company has developed will be included.

Sub-stations Nos. 1 and 5 will receive power at 12,000 volts, while Nos. 2, 3 and 4 will receive power at 44,000 volts. Transformers and switching equipment will be of the Westinghouse latest design, and the Westinghouse developed power indicating and limiting equipment will be installed.

Thirty-nine electric locomotives are required for the initial electrification, including 6 express passenger, 11 local passenger, 15 road freight, and 7 switching locomotives. The main points of interest about these locomotives are given in the following table—

Type Loco.	Weight. Tons.	Length. Ft.	Ins.	Wheel Arrangement.	No. of Motors.	Total H P.	Max. Speed. Miles per hour.
Express passenger	127	58	6	2-6-0—0-6-2	6	2,250	62½
Local passenger ...	80	40	6	0-4-0—0-4-0	4	1,500	56
Road freight ...	113	49	10	0-6-0—0-6-0	6	1,680	40
Switching	65	40	0	0-4-0—0-4-0	4	480	34

All locomotives will be equipped with Westinghouse motors, and the express passenger and road freight locomotives will be equipped with the Westinghouse system of regenerative braking, with its latest developments. The service which the local passenger locomotives will perform will not require or justify the regenerative braking feature.

The fact that this contract includes only the first railroad zone indicates the magnitude of the project of electrification which Chile has undertaken.

PAULISTA RAILWAYS BEGIN ELECTRIC OPERATION.

The freight locomotives recently shipped from Pittsburgh, Penn., by the Westinghouse Electric and Manufacturing Company to the Paulista Railways of Brazil are now in service between Jundiahy and Louveira. These electric locomotives are the first to be used in Brazil, and the inauguration of electric service there represents an important step in the electrification of South American railroads. The new locomotives haul trains of from 43 to 45 units over grades as steep as 1·5 per cent. The so-called "unit car" is of 10 tons gross weight, and the term refers to the old wooden car of thirty years ago. Modern cars are said to be two, three, or four units, according to their size and load. Thus a train of 45 units represents 450 tons weight and is approximately 675 feet in length. Under former steam operation such trains could not be carried over a 1·5 per cent. grade at a speed greater than 9·25 miles per hour. The Westinghouse locomotives make such grades at 28 miles per hour, which means trebling the capacity of the track and greatly increasing the speed of handling freight shipments.

TROLLEY OMNIBUS IN CANADA.

First Railless Car for the Dominion Purchased by Toronto.

The Toronto Transportation Commission has recently placed an order with the Packard Ontario Motor Car Company for four complete trolley omnibuses for service in the city of Toronto. Bodies for these vehicles will be built by the Canadian Brill Company, and all electrical equipment will be supplied by the Canadian Westinghouse Company. The omnibuses will be completely assembled in Canada by the Packard Company. This is the first installation of the kind ordered for Canada.

The cars will be similar in construction to the demonstration vehicle completed by the Packard Motor Car Company on August 22, 1921, and will be used to furnish transportation service in the outlying districts of Toronto.

The electrical equipment will be practically the same as that used on the Packard demonstration omnibus

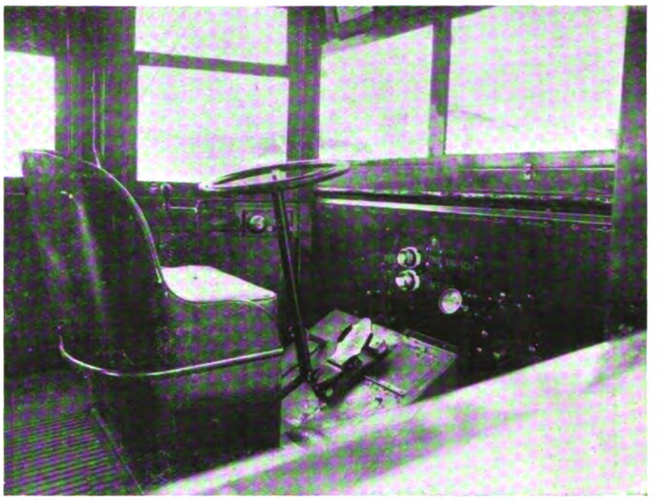

Fig. 1.—Operator's Position in Toronto Trolley Omnibus.

mentioned above and on the machine recently completed by the St. Louis Car Company, and now in Detroit for demonstration purposes.

The design of the electrical equipment is such that no unsightly or bulky portions of the apparatus are placed inside the body of the vehicle, the only portions of the apparatus inside of the body being two snap switches, the reverser handle, the overload trip and reset buttons, and the foot pedal. The control is of the all-foot type, making use of a well-designed foot pedal pivoted at the instep so that the operator's foot rests comfortably upon the pedal at all times. The foot pedal, through a suitable linkwork, revolves the drum of the master controller, which is interlocked with the offset knife-blade type reversing switch. Three points are definitely indicated in the operation of the foot pedal; the first is a slow speed switching point for use when the vehicle is following very slow moving traffic, the second gives series running, while the third or last position is the parallel or full speed notch.

Time Element Control Without Disadvantages.

The master controller, in conjunction with a sequence relay, controls the functioning of a motor-driven sequence switch. The drum development of the latter provides for the closing of the various contactors in

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the proper sequence to accelerate the omnibus to the full series position, accomplish transition, and complete the acceleration to the full parallel position. Within certain limits the speed at which the sequence switch drum revolves is inversely proportional to the current flowing through the main motors; however, it is impossible to completely stall the sequence switch motor, so that this scheme of operation also affords the benefits derived from a time element control without the disadvantages ordinarily encountered. Thus it will be seen that when the omnibus is heavily loaded or ascending a grade the acceleration is slower than when the omnibus is running light on a level street. At the same time the acceleration is positive under all conditions of load and grade. There is no necessity for auxiliary bypass buttons or notching levers, often required when automatic control is applied to city service.

A double-pole line switch in connection with a suitable overload trip offers protection to the equipment from severe overloads. A four-blade double-throw cut-out switch provides for cutting out either of the motors in case of a motor failure. The reversing switch is so constructed that the handle may only be removed when the blades are in the neutral position. When in this position an interlock prevents the master controller from being operated. When the reversing switch is in the forward or reverse position, the same interlock provides protection against any attempt to change its position with the controller "on."

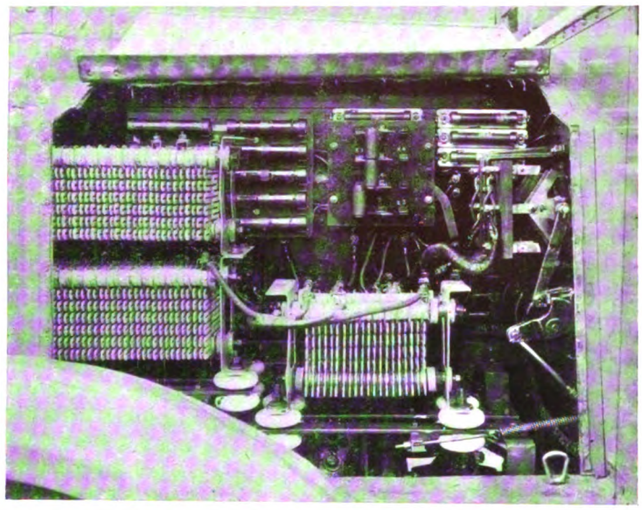

Fig. 2.—Mounting of Electrical Apparatus in Grid Resister Side of Hood Compartment.

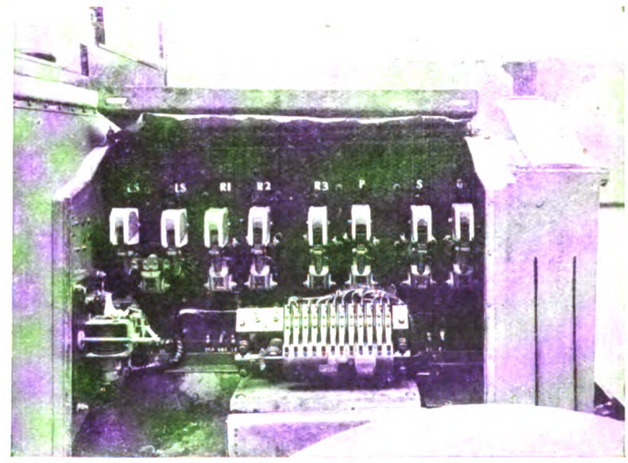

Fig. 3.—The Contactor Equipment is Mounted in the Right Hood Compartment.

The accompanying illustrations show the method of mounting the apparatus in the right and left hand sides of the hood compartment, which is divided by a panel of micarta backed on the resister side with fireproof material. The compartment containing the grid resister is cooled by air passing in through the louvres at the front and downward and outward beneath the omnibus. The contactor side of the hood compartment is also ventilated, while suitable provision is made for guarding against water and dust.

The scheme of control is very similar to that which has been in successful service for the past two years on the Third Avenue Street Railway in New York City. These 50 cars were purchased in July, 1919, and their performance has demonstrated that this scheme of control is well adapted for vehicles operating in city service through traffic of varying density.

New Development of Current Collector.

The current collector, or trolley, which will be furnished to the Toronto Transportation Commission, consists of a special single R.D. Nuttall base with a single pole approximately 14 feet long, at the head of which is a specially designed casting provided for the mounting of two separate arms of insulating material, each 24 inches long. These arms are connected to the pole head casting through a spiral spring approximately 2 inches in diameter and 6 inches long, permitting the arms to swing freely in any direction. Immediately beneath the spring are hinged steel rods so connected to the pole head casting and the casting supporting the tube which forms the arm that the spring is in tension when the trolley is on the wire. This feature permits of only a slight deflection in the downward direction of the arm, but at the same time permits it to swing freely sidewise or to follow the vertical deviation of the trolley wire. At the end of the two insulating tubes are mounted ball bearing swivel harps of cast aluminium, so designed that it is very difficult, if not impossible, for the trolley wire or cross suspension wire to become entangled in them.

The omnibus will be propelled by two Westinghouse type 508A sleeve bearing railway motors of standard design, with the exception of the shaft, which will have a tapered extension at either end so that the two motors will be interchangeable, and either may be used in the front or rear position of the omnibus. The motors will be connected in tandem, and mechanically secured to the drive with flexible couplings.

FRENCH ENGINEERING COURSE FOR BRITISH STUDENTS.

The Société des Ingénieurs Civils de France informs us that the French engineering firms of Lorraine district (rolling stock, railway materials, etc.) have kindly consented to accept for a period of two or three months a few British engineering students during their summer holidays. Application in writing, stating age, qualifications, and giving references, will be received (until further notice) by the Hon. Secretary, British Section of Société des Ingénieurs Civils de France, 45 Great Marlborough Street, London, W.1. The students will not receive any salary, and will make their own arrangements for the journey, board and lodging. Local members of the Société will give advice in these matters if desired. The students, in their own interest, will undertake to submit to the same discipline and working hours as their French colleagues on the works staff. Some knowledge of the French language is desirable.

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SANDBERG SORBITIC STEEL FOR TYRES.

The question of obtaining harder tyres has been the subject of a good deal of thought and consideration on the part of tramway engineers for a long time past, but it was not until 1921 that the British Engineering Standards Association drew up and published a standard specification for tramway tyres. This standard specification calls for a tensile strength of from 60-70 tons per square inch and for a certain deflection under the falling weight test.

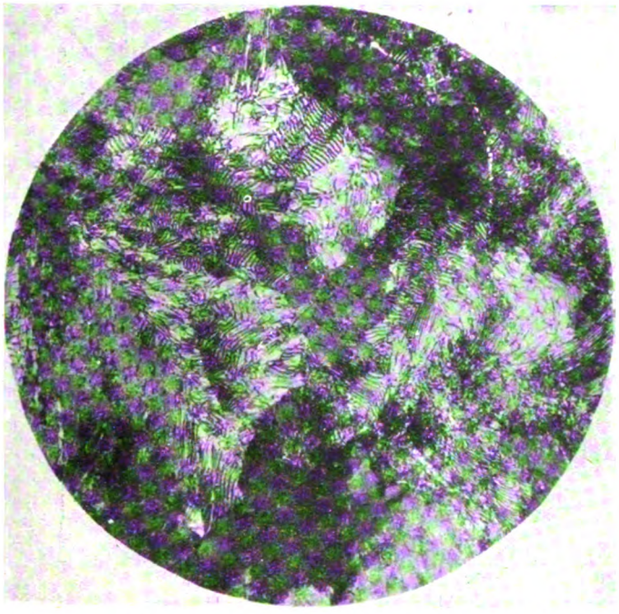

Fig. 1.—Untreated Railway Tyre magnified 250 times,
showing the coarse granular structure of steel in the pearlitic condition.

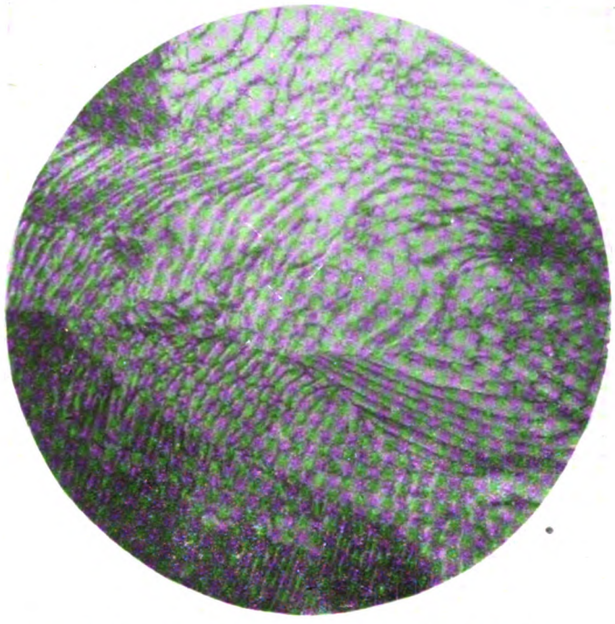

Fig. 3.—Untreated Railway Tyre magnified 1000 times,
showing distinctly the lamellæ of the pearlitic structure.

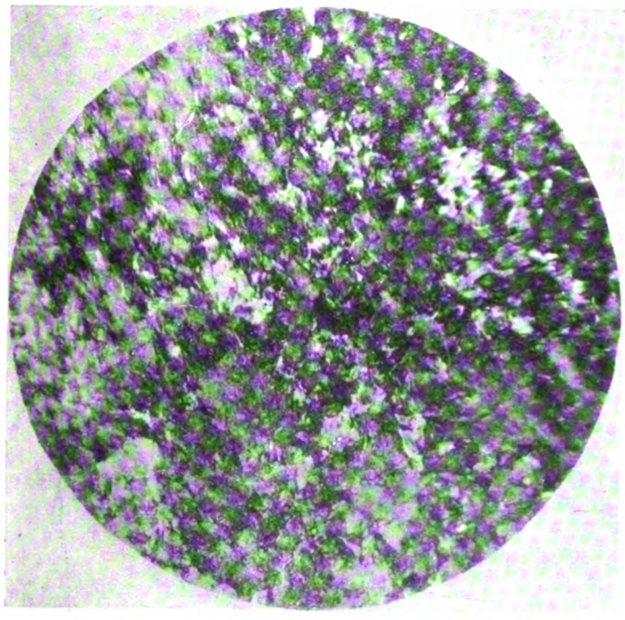

Fig. 2.—Treated Railway Tyre magnified 250 times,
showing the fine grain homogeneous structure of steel in the sorbitic condition.

Fig. 4.—Treated Railway Tyre magnified 1000 times,
showing the evenness of the homogeneous structure of sorbitic steel.

Tramway engineers, however, are not particularly concerned with obtaining a specified deflection under the falling weight, provided that the tyre withstands a reasonable amount of shock. What they are concerned mainly with is the obtaining of a tyre which is hard and which has a very high elastic limit.

Cars come into the shops for attention to the wheels owing to one or more of three causes, namely—

Flange wear.

Detrusion of the tread due to the steel having been stressed beyond its elastic limit.

Flat spots caused by skidding wheels.

If the steel of the tyre has such a high elastic limit that in service conditions it is not stressed to this amount, detrusion trouble ceases; while increasing the hardness of the tyre reduces the amount of actual wear and also results in the skidding wheel not producing so bad a flat spot as a softer tyre.

With a view to obtaining greater increased life of

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tyres, Messrs. C. P. Sandberg, of 40 Grosvenor Gardens, have been experimenting for a considerable time with their patent process for producing sorbitic steel, and as a result of these experiments tyres can now be offered to tramway authorities with a higher tensile strength and higher yield point than has up to the present been possible.

Medium carbon steels, in the ordinary normalised condition, have, when examined under the microscope, a coarse granular structure consisting of pockets of pearlite surrounded by bands of ferrite or pure iron. The pearlite consists of alternate lamellæ of ferrite and carbide of iron. This pearlitic structure is clearly indicated in Figs. 1 and 3, the first showing the appearance of steel in the tyre magnified 250 times, and the second the same tyre magnified 1,000 times.

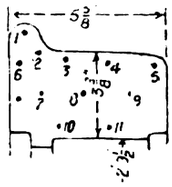
normalised condition gave an ultimate breaking stress of 58 tons after treatment showed an ultimate breaking stress of 76 tons with a yield point of 58 tons, which is the same figure as the untreated ultimate strength. The elongation of 14 per cent. and the behaviour of the tyre under the tup test show that an ample margin of safety is secured.

The second table, referring to a tramway tyre in which the steel had a higher carbon content, shows a breaking stress, after treatment, of 81 tons, while the normalised tyre had a breaking stress of 59 tons.

Still better results have been obtained on tyres which have been ordered by one of the large tramway authorities in this country, when an ultimate breaking stress of 85 tons, with a yield point of 62 tons per square inch, was obtained with ample elongation and

SANDBERG SORBITIC STEEL.—Railway tyres, 2 ft. 9½ in. internal diameter, 5⅝ in. by 3¾ in. section. Analysis—Carbon ·73; silicon, ·313; manganese, ·74; sulphur, ·033; phosphorous, ·038. All tyres made by the United Steel Company.

Tyre No.	Cast No.	Treatment	Drop Tests 10′	15′	20′	25′	30′	30′	30′	30′		Tensile Test Breaking Stress Tons, [ ] In.	Yield Point Tons, [ ] In	Elongation %	Reduction %
1	6861	Full Sandberg	⅝″	1″	1 7/16″	1 11/16″	2¼″	2⅝″	3½″	3⅜″	Not broken	76·4	58·0	14·0	15·8
2	6861	Cooled in Atmosphere. Reheated to 850° ...	⅜″	1″	1 11/16″	2⅝″	3 7/16″	4 11/16″	5 1/16″	Broke at Bottom		58·21	—	13·0	18·3
3	6861	Cooled in Atmosphere ...	⅜″	7/16″	1⅝″	2 7/16″	Broke at bottom					57·32	--	10·8	10·08

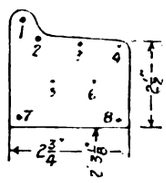


Brinell Numbers. 3,000 kgs. on 10 mm. Ball for 15 secs.

No.	1	2	3	4	5	6	7	8	9	10	11
1	331	311	321	321	331	302	302	302	302	255	269
2	248	248	241	241	241	248	241	241	241	235	230
3	269	252	262	262	269	262	262	255	255	255	248

SANDBERG SORBITIC STEEL.—Tramway tyres, 2 ft. 3⅛ in. internal diameter, 2¾ in. by 2½ in. section. Analysis—Carbon, ·78; silicon, ·322; manganese, ·71; sulphur, ·033; phosphorous, ·036. All tyres made by the United Steel Company.

Tyre No.	Cast No.	Treatment	Drop Tests 3′	5′	7′	9′	11′	13′	15′		Tensile Test Breaking Stress Tons, [ ] In.	Yield Point Tons, [ ] In.	Elongation %	Reduction %
7	8550	Full Sandberg	½″	1″	1⅜″	1 11/16″	2½″	3¼″	Broke		81·2	52·0	13·0	20·2
8	8550	Cooled in Atmosphere. Reheated to 840°	7/16″	1 3/16″	Broke						58·92	--	15·0	23·04
9	8550	Cooled in Atmosphere ...	½″	1¼″	Broke						61·96	--	Broke off close	



Brinell Numbers. 3,000 kgs. on 10 mm. Ball for 15 secs.

Tyre No.	1	2	3	4	5	6	7	8
7	341	341	341	341	321	331	269	285
8	255	255	255	262	241	255	248	255
9	285	269	269	285	269	269	262	285

The heat treatment of steel for the purpose of resisting wear has as its aim the breaking down of the coarse granular structure and substituting a homogeneous structure. This homogeneous structure produced by the Sandberg process is clearly shown in Figs. 2 and 4, which are micro-photographs of the same steel as Figs. 1 and 3 after it had been treated by the Sandberg process. It will be observed that the granular structure has been entirely broken down, the pearlite having been converted into sorbite.

The changes in the structure of the steel obtained by the Sandberg process are accompanied by very decided increases in the tensile strength of the steel and in the hardness. Attention is drawn to the attached tables, which show results of the Sandberg process obtained on tyres of standard diameters.

The first table has reference to railway carriage tyres, and it will be noted that a steel which in the

resistance to shock under the tup test. The Sandberg process is one which may be described as a process of slow quenching. Owing to the simplicity of the process remarkable uniformity in any batch of tyres is obtained. The process consists of cooling the tyre through the critical range of temperature by projecting against it, as it is slowly rotated, very large quantities of air into which atomised water is introduced. The tyre is carried through the critical temperature in some 3½ minutes, and no further heat treatment or re-heating is required.

Tyres of this quality have not been offered to tramway authorities until lately, so that no actual results in service are yet available. In the early days of the process, however, a large number of the railway companies in this country ordered trial lots, and the results obtained on these are most encouraging.

On one electric railway, tyres which in the untreated

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condition had an ultimate strength of 52 tons per square inch, and in the treated condition an ultimate tensile strength of 66 tons per square inch, have shown an increased mileage between visits to the wheel shop for turning of 72 per cent., while on another electric railway the corresponding figure was 70 per cent. These tyres had only an ultimate strength of 66 tons, and it is due to the improvements in the process since the time when the tyres referred to went into service that much higher tensile strengths are now obtainable.

From the standpoint of maintenance costs, the increased life of tyres is of the greatest importance to tramway engineers, as apart from the saving in material, considerable economies are effected in shop labour charges through the less frequent visits of the vehicle to the shops for wheel changing, while greater use of the vehicle itself is obtained owing to its being out of service less frequently; in other words, the earning capacity of the capital asset is increased.

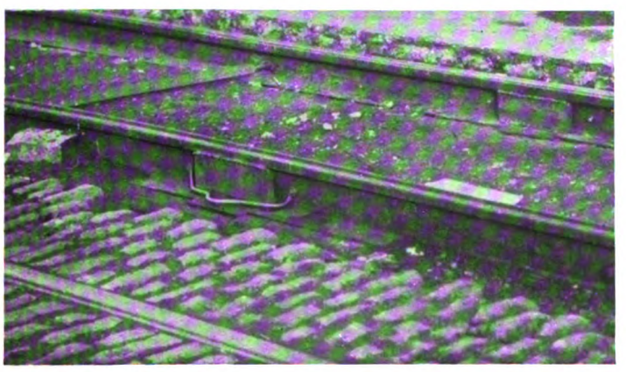
Sorbitic steel is both hard and tough without being brittle, and is therefore well suited to withstand the severe shock and strains as well as the abrasion to which tyres are subject.

It is by the courtesy of Messrs. Steel, Peech and Tozer, Limited, who manufactured and treated the tyres referred to, and to Messrs. C. P. Sandberg, of 40 Grosvenor Gardens, S.W.1, that we are able to furnish our readers with particulars of this important advance in tyre manufacture.

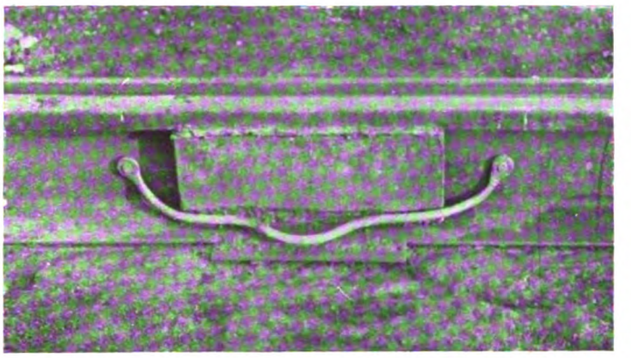
BOLTON'S PATENT TRAMWAY JOINT.

The accompanying photographs show an extremely simple electrically welded rail-joint which is now being used by the Sheffield Corporation. It is the invention of Alderman Bolton, a member of the Sheffield City Council, and has been patented by him.

The short fishplates are rolled to a special section to facilitate the welding, and a very light sole-plate is also welded to the underside of the rails. There is a considerable saving in the weight of metal, no fish-bolts are required, and it is claimed that bonds can also be dispensed with, though (as the photographs show) a single bond has been used at each joint as a matter of precaution. The fishplates are forced into position by a special set of clamps which form part of the patent. Some hundreds of these joints are now in use in Sheffield; before they were tried, comparative tests were made of welded joints built up with ordinary fishplates fastened with nuts and bolts.



Bolton's Patent Electrically-Welded Tramway Joint.



Bolton Tramway Rail Joint.

The tests of the "Bolton" special joint were highly satisfactory, as the attached particulars show.

All the joints used in Sheffield up to the present have been on renewal work. This means that after a joint is made the full service is running over the loose rail probably for two or three days before the track is packed and concreted.

It is difficult to imagine any more severe practical test, and we are assured that not one of the joints has given the least trouble. If a joint will stand this there is not much doubt it will stand the wear and tear of ordinary traffic when properly concreted and paved.

TESTS MADE OF STEEL TRAMWAY RAIL JOINTS AT MESSRS. H. BESSEMER & COMPANY'S WORKS, MARCH 16, 1921.

Weight of Tup.	Bearings Apart.	Fall of Tup in feet.					Remarks.
		2 ft. 6 in.	2 ft. 6in.	2 ft. 6 in.	2 ft. 6 in.	5 ft. 0 in.	
		1st Blow	2nd Blow	3rd Blow	4th Blow	5th Blow	
1 ton.	3 ft. 6 in.	Deflection $\frac{1}{8}$ in.	Deflection $\frac{1}{4}$ in.	Deflection $\frac{1}{4}$ in.	Deflection $\frac{1}{4}$ in.	Broken.	One fishplate broken.*

* Bottom plate broken away from flange at one end. Welding along fishplates sound.

"THE PASSIMETER."

NEW TIME-SAVING SCHEME ON THE UNDERGROUND.

There has been installed experimentally at Kilburn Park Station, London (on the Baker Street and Waterloo Railway), a new time-saving system for passenger booking, known as the "Passimeter." The management of the Underground Railways have long considered that both delay and inconvenience arise from the old system of issuing tickets to passengers and the examination and cancellation which immediately follows the issue. The fact that this system has been in operation on railways beyond memory is, the management state, no recommendation to them; their task involves a ceaseless effort to find some new

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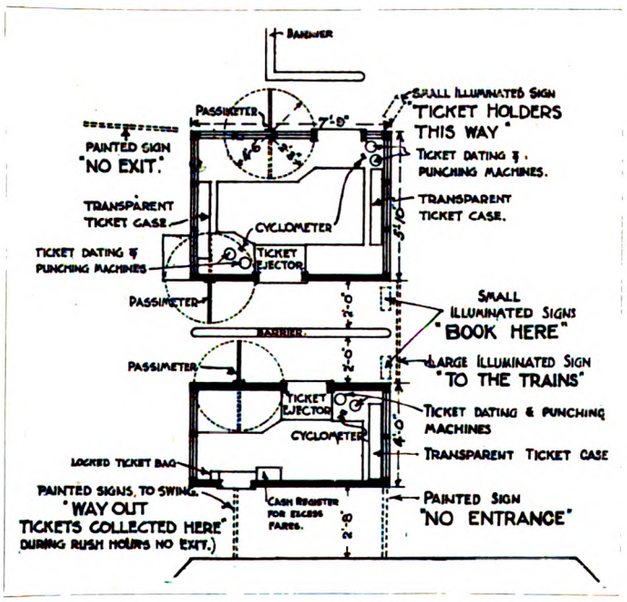
way of "snatching seconds from the maw of time." Where millions of passengers have to be transported daily, mainly in massed rushes during two comparatively short morning and evening periods, any device which may save even a fraction of a second per passenger is worth a trial. Any device which does save it

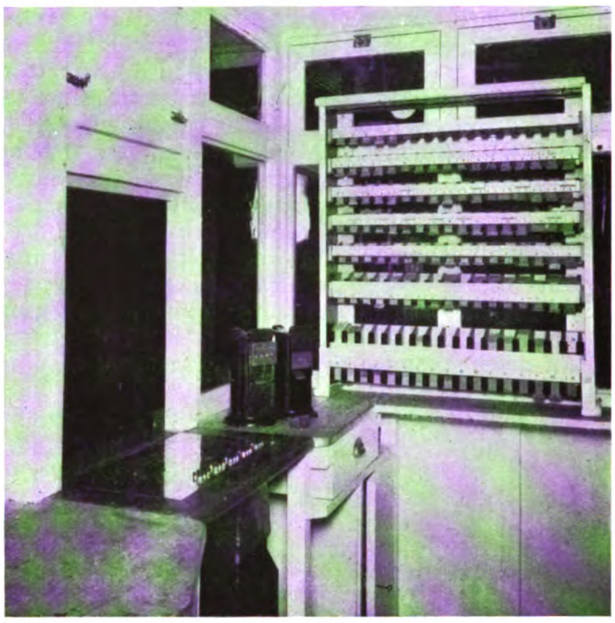
Entrance to Booking Office, showing Passimeters.

assures, in the aggregate, an enormous gain in speed and facility of operation. Many such appliances have already been tried from time to time on the Underground—generally with good results.



Plan of New Booking Offices at Kilburn Park Station, showing Passimeter.

The "Passimeter" system involves the use of three separate registering cyclometers—two automatic, one non-automatic. The first registers the dating and cancellation of each ticket, setting the passenger free to proceed through the "Passimeter." This, as will be seen from the accompanying plan, is really an elaboration of the familiar turnstile, and it operates another cyclometer which automatically records each individual's passage. With the third cyclometer the booking clerk registers the passage of season-ticket holders. From the "Passimeter" the traveller goes straight on to the lift, escalator, or platform, as the



Interior of Booking Office

Showing Ticket-Issuing Machine, Ticket Dating and Cancelling Punches, and New Type of Ticket Case

case may be, without any ticket examination at the customary barrier. Ticket collection is, however, still carried out in the usual way.

It will be seen therefore that a complete record is kept of every traveller who enters the station.

The experimental offices at Kilburn Park Station are also equipped with an "Automaticket" machine similar to that which had been previously tested with success at Leicester Square Station, and which was illustrated and described in our issue of May 19, 1921. Local tickets, which represent 75 per cent. of the issues, are delivered from this machine by a very simple method. With the mere pressure of a small plunger, like that of an electric bell-push, the booking clerk can issue any number of tickets up to five of any one denomination. The machine can thus deliver five tickets just as quickly as one, and far more speedily than one ticket can be issued in the ordinary way. The system promises a great simplification, for instance, of the evening theatre bookings by parties.

The combined "Automaticket" and "Passimeter" booking office at Kilburn Park is designed to provide comfortable quarters for the booking clerk, and by careful attention to detail in construction every available inch of space has been put to use. The ledger desk, it may be instanced, is made to the exact size of the ledger. There is no waste space, and a stock of 250 different kinds of tickets is located so that all are within easy reach of the clerk. Experiment is also to be made with steel ticket-cases in place of the ordinary wooden holders, with a view to further space saving and greater cleanliness. If the tests now being made at Kilburn Park prove satisfactory, the scheme will be extended to other stations on the Underground.

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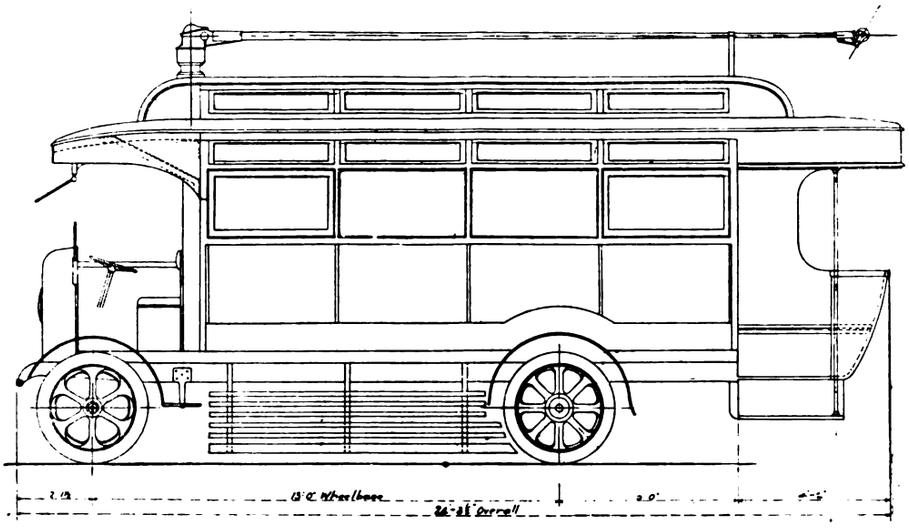
NEW RAILLESS OMNIBUSES FOR BLOEMFONTEIN CORPORATION.

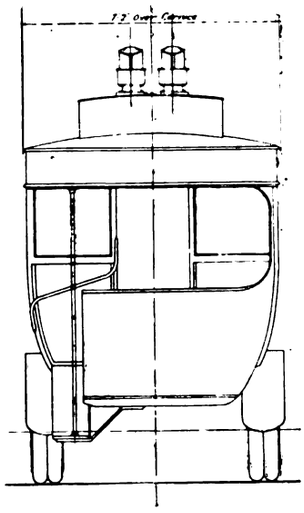
The first of the new railless cars which Railless, Limited, are constructing for the Bloemfontein Corporation has just been completed, and by the courtesy of the contractors a number of those interested in the development of trolley omnibuses were given an opportunity on January 13 of inspecting the car and testing its running. By the courtesy of the Leeds Corporation the omnibus was run over their railless route, and it is no exaggeration to say that the party were greatly pleased with the smooth riding and ease of control which characterised the new machine. There is no doubt that these vehicles attain a very high standard of comfort, power, and reliability, and are admirably adapted to meet the conditions of service for which they are designed. The general design of the car will be readily understood from the accompanying illustrations. There is ample seating room for 30 passengers, ten seats each accommodating two passengers being arranged across the vehicle, with a gangway through the centre, while there are seats for five passengers who sit at the front of the saloon with their backs towards the driver's compartment. The platform, which is of novel design, has a seat arranged on two sides with accommodation for five passengers.

The body, which is of light but substantial construction, is 15 ft. in length over all, and the width at the waist rail 7 ft. 1 in. over the panels. The height from the inside of the roof to the floor is 6 ft. 3 in., and the height from the road to the rear platform approximately 2 ft. 2 in., and from the road to the car floor 2 ft. 10 in. The underframe rests upon two sole pieces of teak laid the full length of the chassis side members, from which they are insulated by a thick layer of Mascolite felt which prevents the transmission of noise and vibration to the body. The underframe is constructed of teak, carrying floor boards of white pine with pitch pine slats. Down the centre of the vehicle, between the seats, trap doors are provided above the commutator end of the motors and over the worm case inspection covers. The stand and corner pillars are of teak. The roof, as will be seen from the illustration, is of the clerestory type, and the roof sticks are stiffened by means of carlines screwed to their sides. Roof boards of pine matchboarding, covered with canvas, are trussed by steel rods, which serve as hand rails. The front dash and wings are of 18 gauge steel, as are also the external panels. Ample provision has been made for ventilation, for in addition to the fixed windows there are two drop windows on each side of the car. In the front bulkhead there are two fixed windows. The glass of all the windows is bedded on rubber, and the drop windows are balanced on lazy tong fittings. The body has been so constructed that these drop windows can be removed without dismantling the side panels. Hinged ventilators are placed above the side windows, and are so arranged that alternate ones will open. In addition, hit and miss ventilators are fitted at each end of the car.

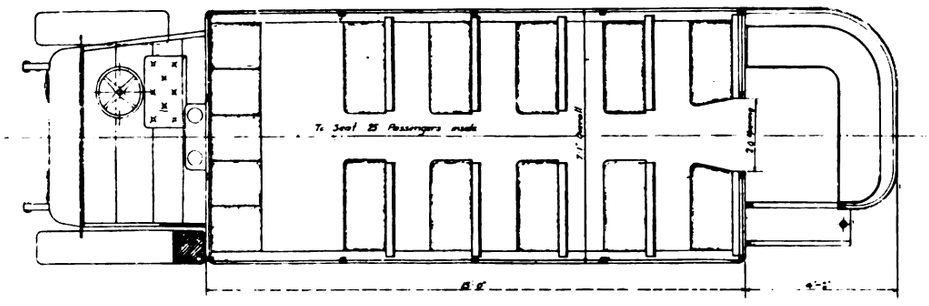
The driver's platform, the arrangement of which is shown in one of the illustrations, is provided with a wind screen of the ordinary motor car type, which is attached to the body by a removable panel on the driver's right. Space under the driver's seat is utilised as a tool locker. The entrance to the vehicle is at



Side Elevation.



Rear Elevation.



Plan.

New Railless Omnibus for Bloemfontein Corporation.

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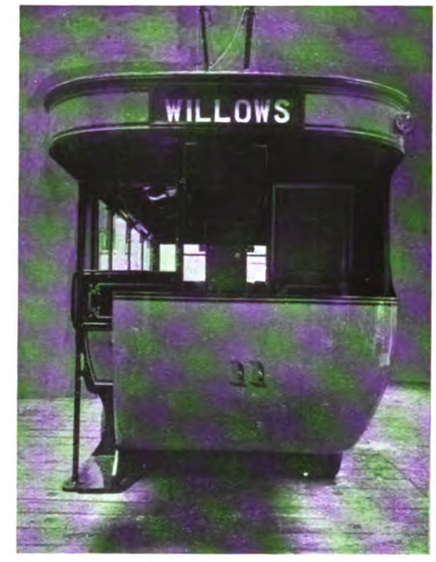
the rear, and the saloon has no door. When the car is fully loaded, the conductor's platform is 2 ft. above the level of the road, and there is only one step, which is fitted with a non-slip tread plate. The platform is supported by teak bearers fitted on the side members of the chassis extension frame. The floor is constructed of pine tongued and grooved boards laid transversely and covered with pitch pine slats.

Driver's Platform.



Rear View.

New Railless Omnibus for Bloemfontein.

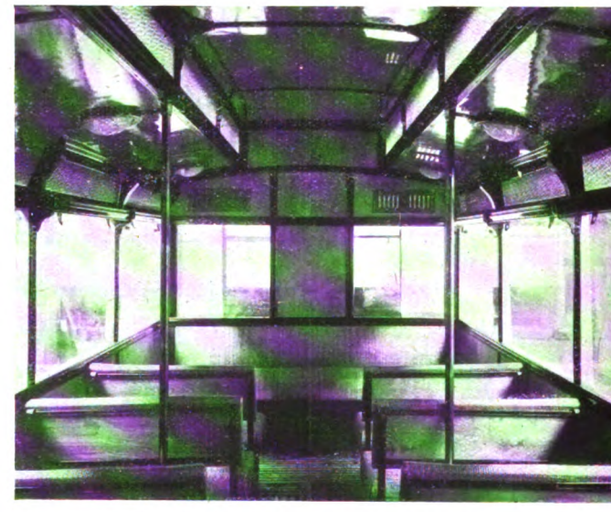
As previously mentioned, the seats are arranged transversely, and the side standards of the seat backs are rigidly secured to the waist rail. Padded spring backs trimmed with rattan are fitted. Spring roller blinds are provided in the front bulkhead on the outside of the body, and spring roller blinds of pantasote are fitted to screen all windows.

The car is wired for 15 lights as follows—Dash lamp, 2; front destination indicator, 2; rear destination indicator, 2; interior of car, 8 (one acting as a front signal light and one acting as a rear signal light); and there is one light on the conductor's platform. All lamps are arranged in three circuits, each circuit being equipped with two switch fuses and five 100-volt metallic filament traction lamps. An electric signal bell is provided, and bell pushes with metallic covers are placed in suitable positions. Destination indicators are built on the ends of the framing of the body.

The chassis is of special design, and is constructed of pressed mild steel channel, the frame being stiffened by cross members between the side members. The rear extension frame supporting the conductor's platform is riveted to the side members, and secured by substantial brackets to the rear cross members of the chassis frame. Springs are of oil-hardened ground spring steel of best Sheffield manufacture. The rear springs, of special design of Railless, Limited, are fitted with supplementary rubber springs of a novel and remarkably effective design on the top of the main laminated bearing springs. These auxiliary springs come into action with the full and overload. The torque is taken on the springs. One of the most arresting features of these vehicles is the fitting of rubber shock absorbers in the spring hangers of the rear springs. This innovation presented considerable difficulty, which has been overcome in a remarkably effective manner, as was proved by the easy riding of the vehicle over a stretch of very rough road.

The front axle is a solid steel forging. Vertical pivots are fitted with ball thrust washers, and are oil lubricated. Stub axles are bushed with hardened steel bushes to take the pivot point.

The vehicle is capable of being turned in a radius of approximately 12 ft. measured on the track of the inner rear wheels. The steering wheel is covered with exonite, with special hand grips moulded on the under side. The steering gear is of the worm and sector type, with case-hardened steel worm and phosphor bronze sector contained in an oil-tight and dust-proof cast steel case. The rear axle is of the live axle type, each road wheel being driven by a separate motor through worm reduction gear. The worm wheels are of the best phosphor bronze, and the worms of special steel case-hardened and ground. Roller journal bearings, ball bearings, and ball thrust bearings are used throughout. The rear road wheels are mounted on phosphor bronze floating bushes in two parts. The worm gear shafts and bearings are



Interior looking towards the Front.

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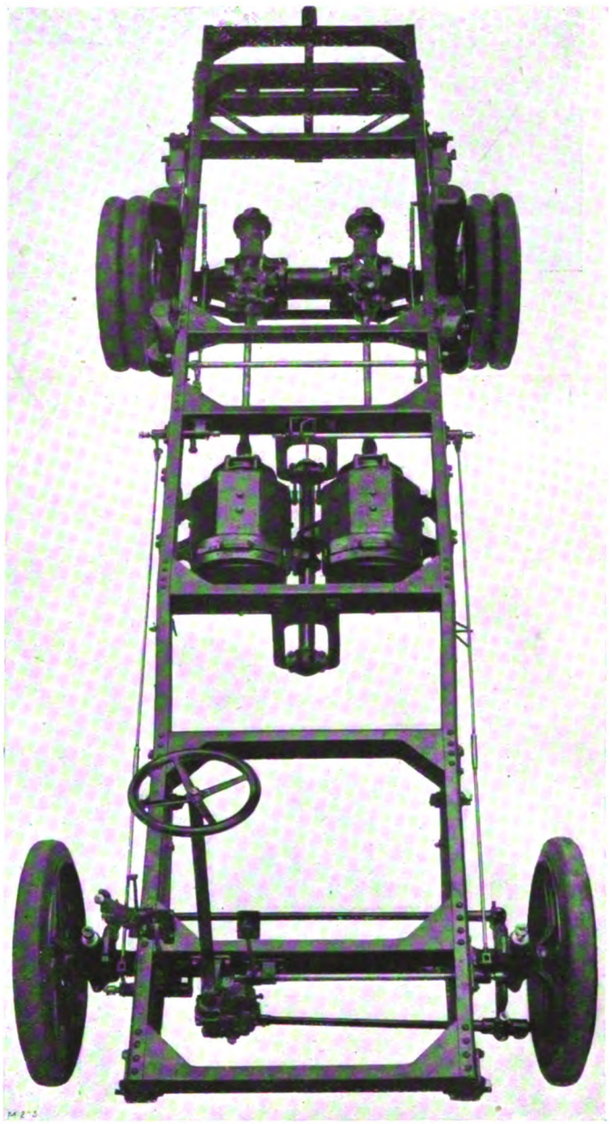
enclosed in an oil-tight dust-proof steel casing so constructed that the bearings and gear can be inspected without lifting the vehicle. The worm shafts are fitted with centrifugal oil throwers to prevent the oil from working out to the front end of the worm shaft, and there are arrangements for the oil to drain back into the bottom of the worm casing. The road wheels are of cast-steel with hollow spokes, with a rim diameter of 771 mm. for 120 mm. Dunlop solid rubber tyres. Single tyres are fitted to the front wheels, and twin tyres to the rear wheels. There are two independent brakes, each of which is capable of controlling and stopping the vehicle when fully loaded on a 1 in 10 gradient. The rear wheel brake is of the internal expansion type, operated by a cam by means of a foot pedal from the driver's platform. Compensating links ensure equal pressure on each wheel brake. There is a light dust-cover over each brake drum, enabling the brake shoes to be readily inspected. This brake can also be operated by a hand lever with ratchet for retaining the brake on after application by the foot pedal or hand lever. The external contracting brake is fitted at the driving end of each motor shaft, and is operated by a foot pedal. It is of a powerful type, and is designed for use in case of emergency. The shoes on both brakes are lined with Ferrodo, secured with aluminium rivets. Adjustable nuts are provided on the pull rods to take up the wear.

Front and Side View.

Side and End View of Bloemfontein Railless Car.

The vehicle is fitted with two electric motors, each having a capacity of 20 B.H.P. on tramway rating at 1,000 revolutions per minute on a 525-volt circuit. The motors are series wound with four main poles and four commutator poles and are arranged for shunt field control. The motors are totally enclosed by the magnet ring and two end shields. The bearings are carried in the end shield, and are provided with Skefko ball bearings and Hoffmann thrust bearings. The controller, which consists of a main and a reversing barrel, provides for forward and reverse running, and for connecting the two motors in series or in parallel. Provision is made also for shunt field control and for cutting out either motor by controlling the other on the series notches. Only the reversing handle is detachable, the power handle being fixed. The main barrel cannot be moved from the off position unless the reversing barrel is in one of the operating positions, while the reversing barrel cannot be moved unless the



Plan View of Chassis.

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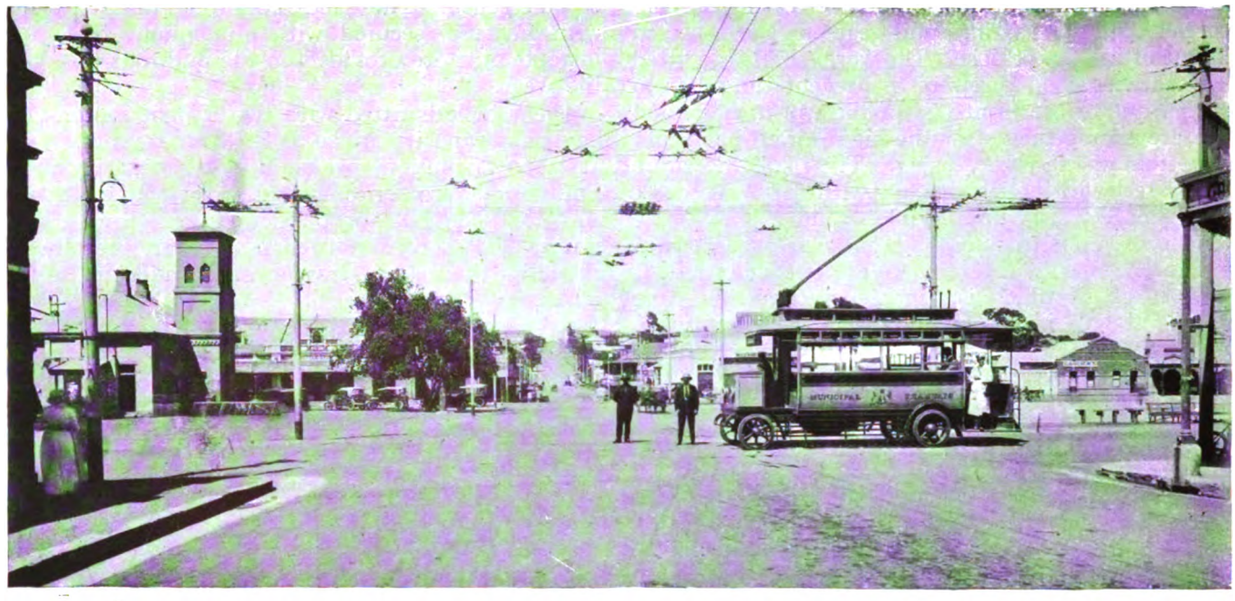
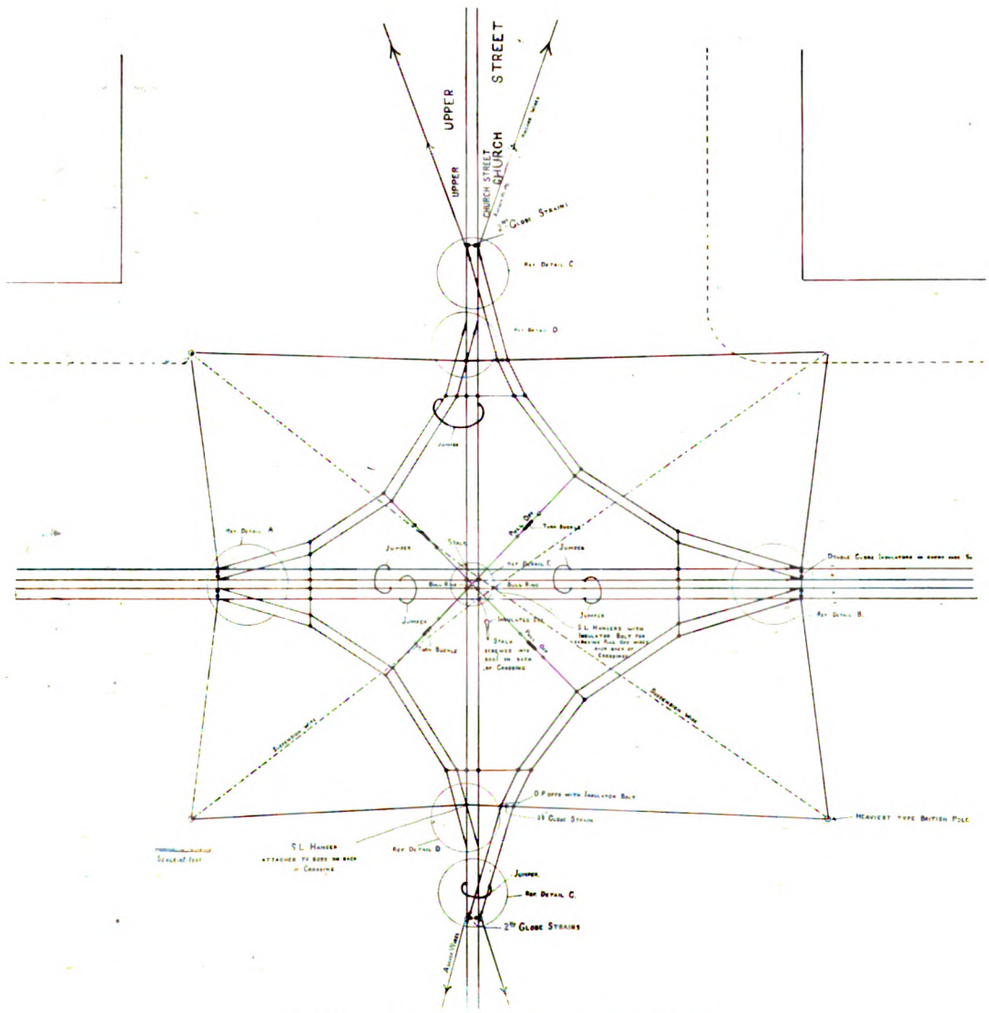


View of Overhead Work at Market Square Junction of Railless Routes at Bloemfontein.



Plan of Junction shown in Illustration above.

JUNCTION OF RAILLESS OMNIBUS ROUTES AT BLOEMFONTEIN.

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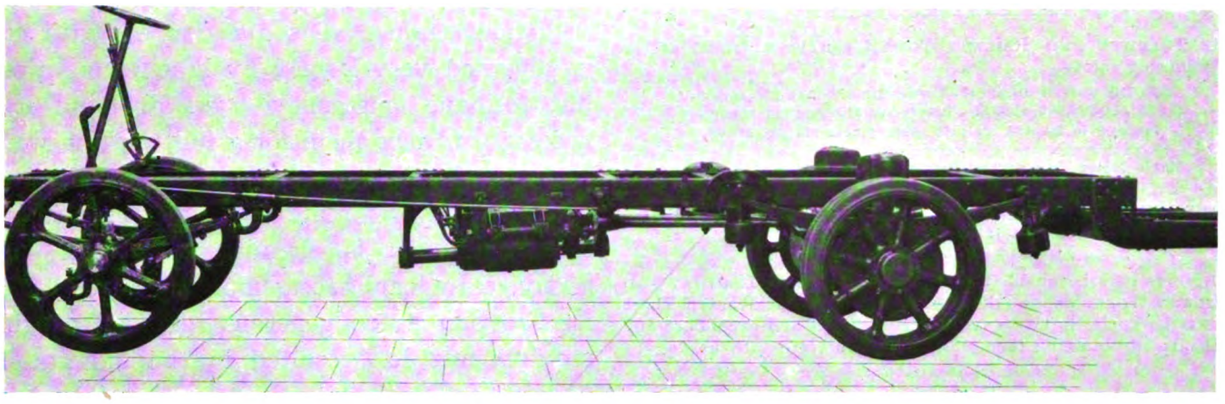
main barrel is in the off position. The main barrel gives nine positions in addition to the off position, five series and four parallel, and the reversing barrel a forward and a reverse.

The controlling resistances in the motor circuits are of the E.M.B. steel grid type. Circuit breakers are of the standard traction pattern, fitted with overload release and magnetic blow-out. The two trolleys are of the Railless patent cam-control type, fitted with ball and roller bearings. These unique trolleys enable the vehicle to deviate on either side of the trolley wires to the full length of the trolley poles without risk of dewiring at any speed.

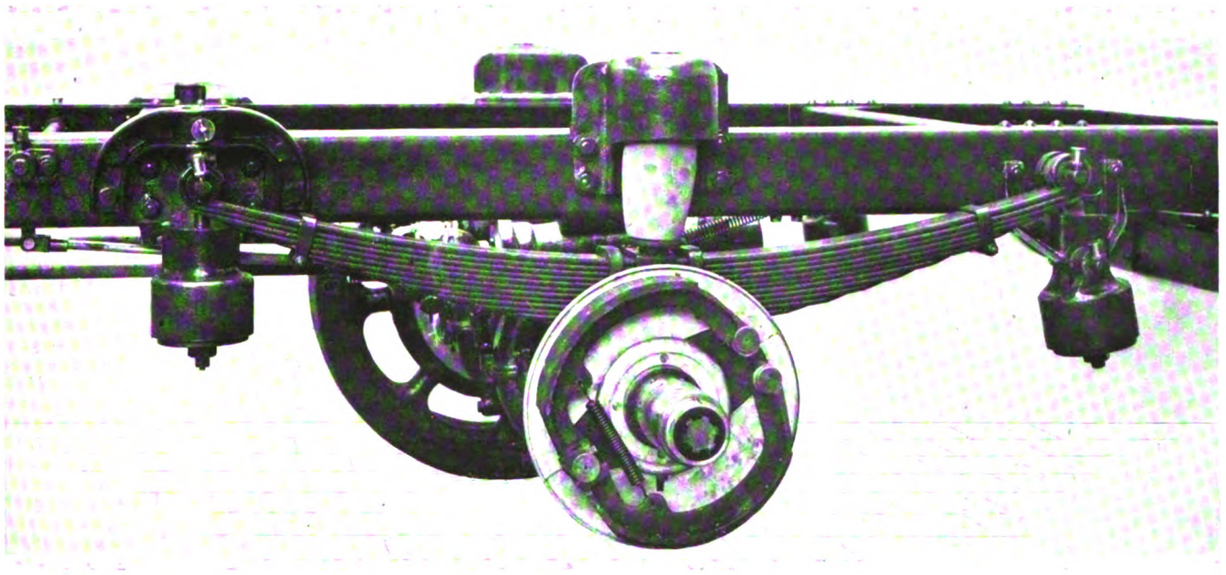
The overhead wiring equipment of the Bloemfontein system was carried out generally upon the standard practice of Railless, Limited, with a double pair of wires, one pair for each journey (outward and return), with treble insulation employing standard tramway overhead line fittings. There is, however, in this installation one feature of the overhead equipment deserving more than passing comment. This is the wiring in the Market Square. Here it was necessary to carry the double overhead wiring across the single pair of wires traversing the length of upper Church Street, and to form curves and junctions connecting each of the four streets converging on the Market Square, so as to make it possible to run straight through on either side, or alternatively to run from one street to the street at right angles on all the four corners.

The plan here reproduced is a copy of the actual plan supplied to the erecting engineer, and shows the general layout. The four junctions are shown, as also is the central crossing accommodating six trolley wires, which is seen in the middle of the plan. The insulated fittings, crossings, frogs, and points were all of the special design of Railless, Limited, and it is satisfactory to record that no trouble has ever been experienced with them. Although this work represents one of the most complex pieces of wiring that has yet been accomplished, the report of the erecting engineer after six months' operation stated that not a single trolley wheel had left the line, either at the Market Square junctions or at any other portion of the route.

In a subsequent issue we hope to describe in detail the actual construction of the various fittings employed.



Side Elevation of Chassis of Railless Omnibus for Bloemfontein.



Arrangement of Springs at Rear Wheels.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JANUARY 19, 1922.

Adjustment of Hours.

From the Government down to the agricultural labourer the country has had to realise that it is impossible to have in all respects "a land fit for heroes." Universal sympathy attended the efforts that were made after the war to bring Utopian conditions into existence, but in nearly every direction disillusion was inevitable. The mistake was made of seeking too much in a world made nearly bankrupt by war. It is now generally recognised that improvements can only be effected gradually, as economic conditions permit. The traction industry was one in which a mistake was made by unwarranted generosity. Not only was the eight-hour day universally conceded, but this was restricted within a too limited spreadover. In other directions also innumerable difficulties have arisen since the ratification of the national agreement in the tramways industry in March 1919. Hence the fact that arbitrations have had to be conducted on disputed points. With the present spreadover the undertakings have found it impossible to provide efficiently for the public requirements. The fall in working costs proceeds but slowly, and it is to be feared that when the financial year ends on March 31 the results will be found to be as unfavourable as these of the year ended March 31, 1921, when thirty undertakings had to call upon the ratepayers to make good the losses incurred. Two instances of the difficulties attendant upon the restricted spreadover and the wages of spare hands may be quoted as typical. At Leeds the department is hindered in dealing with the rush hour traffic. The question of extra cars is governed very largely by labour conditions, but to have emergency crews at hand it is necessary to pay them for a full working week. Their employment on extra cars at rush times would not approximate to a full week, and as the department is already losing over £150 a day, extra cars are a financial impossibility. At Croydon a too generous regard for public requirements has resulted in the undertaking paying £38 per month to men for doing "nothing." That Tramways Committees are desirous of ending this financial burden by means of a revision of the national agreement is not surprising. The omnibus workers of the country have already, on the advice of their organisers, assented to revision, and it now remains for tramway employees to meet the difficulties of the times with good will.

Accidents at Stopping Places.

The question of accidents to passengers at tramway stopping-places is raised again by the action of the London County Council. The remedy which has been suggested in various places is to impose a by-law obliging the driver of any vehicle desiring to pass a stationary tramcar on the near side to pull up while any passengers are leaving or entering the car. It has long been known, and the Highways Committee of the County Council confirm the fact, from their own inquiries, that the driving of vehicles past stationary cars on the near side is the cause of many accidents. The committee conferred with the Minister of Transport on the subject last year, but he thought it doubtful whether he had power to sanction such a by-law as that proposed, and that in any event it was unlikely that he would consider it desirable to do so. The necessity of securing greater safety at stopping-places was represented to the Ministry last autumn by the Municipal Tramways Association, and the London County

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Council are fully justified in calling official attention to the increase in the number of accidents, and asking what steps it is proposed to take to safeguard the public. Within recent time several English municipalities have unsuccessfully tried to get powers to prevent vehicles from running in among passengers at stopping-places. The only case where a by-law for the purpose seems to be in existence is Glasgow. Under a private Act passed some ten years ago the Corporation secured wide powers to make by-laws, and in 1915 they made one obliging drivers of vehicles on the near side to pull up at tramcar stopping-places so long as passengers are leaving or entering a car. The by-law was sanctioned by the Sheriff of Lanarkshire and confirmed by the Secretary for Scotland. No particular complaints as to its operation appear to have been made, and there seems to be no reason why it should not work successfully in the large provincial towns of England. In the case of London, however, there is great strength in the contention that such a by-law would create intolerable street blocks. The volume of general traffic on the main thoroughfares of London is so great, as compared with that in any other town, that the by-law would be likely in some places at least to produce an almost perpetual hold-up. At some points there is a car at the stopping-place most of the time. Moreover the traffic coming in the opposite direction is often so great as to make impracticable the alternative of vehicles passing the car on the off side. The near side is frequently impeded by omnibuses stopping at or near the places where the cars stop, and that also is a feature either absent or much less pronounced in other towns. A satisfactory solution for London will not easily be found, but the increase in accidents must be prevented. Undoubtedly the danger can be greatly minimised if drivers of motor vehicles take greater care and recognise that pedestrians have a perfect right to the use of the roadway when entering or alighting from tramway cars. This is a remedy that can be immediately applied, and from all points of view it would be preferable to the imposition of any hard and fast rule creating fresh interference with the movement of street traffic.

Awards to Employees. The action of the London County Council in approving a scheme submitted by the general manager of the tramways for awarding prizes to employees who make practical suggestions for devices likely to be of advantage will be generally welcomed. Awards will be made by an examining committee consisting of the general manager and the heads of the five branches of the tramway department. The total amount to be distributed—£200 a year—is not large, but the payment in each case is to be determined by the merit of the suggestion. If the scheme works well the Council may, of course, in the future find it desirable to increase the amount of the prizes. There seems to be no reason why the scheme should not work well. It is already in operation on some British railway systems, and has from time to time resulted in the production of useful improvements. Moreover, it gives encouragement and excites the interest of employees who are of an inventive or mechanical turn of mind; and in this way tends to reduce the monotony of routine. It helps to a realisation of the fact that they may be proud of the great undertaking with which they are connected. In large tramway systems the scheme should be more productive than in the case of small undertakings, because the larger the number of employees the more chance there is of latent talent being found. But even the smaller undertakings may have in their employment men who, finding practical difficulties in their everyday work, may have the ingenuity to devise remedies for them. If there is no system of awards, no mental incentive, then it may well be that "many a flower is born to blush unseen." A scheme of the sort costs little, and such expenditure as is incurred may be repaid a hundredfold.

Overhaul of London Cars. Tramway undertakings within the Metropolitan area are subject to various disabilities which do not apply to tramways in other parts of the country. One of these is the requirement of the Commissioner of Police that all cars must be painted and varnished once a year. This has to be done before they are presented for the annual renewal of their licences. The time required for painting is also used for the general overhaul of the trucks, electric equipment etc. It seems that experience

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has shown that generally it is not necessary to have a complete overhaul of the mechanism as often as once a year, seeing that ordinary running repairs and adjustment are regularly carried on. The London County Council are accordingly making representations to the Home Office, which is the department governing the Metropolitan Police, to the effect that renovation and overhaul should be done on a mileage basis, as in the case of railways. Expert advice to the Council is that it would be sufficient to carry out such work on the completion of each 75,000 miles, which would give an average time between overhauls of about two years. This would effect a saving in labour of £35,000 a year, and an ultimate saving of £175,000 on capital expenditure, as fewer cars would be required. If all this money can be saved, it is clearly not worth while to spend it merely in order that the woodwork of the cars should always be resplendent in new paint and varnish. These external coatings might stand for two years without becoming unsightly. In other parts of the country the local authority has freedom to regulate times of painting as it likes, and surely the same discretion should be left to London tramway managers. The London General Omnibus Company has to submit to the same regulation regarding annual painting of omnibuses, and at that time general overhaul of the vehicle is also carried out. It seems probable, however, that in any case an omnibus will require overhaul more frequently than a tramcar, as it is subjected to much greater vibration, that it has a high speed reciprocating engine, and gearing that is subjected to great and constant strain.

THE AGREEMENT OF MARCH 1919.

SUB-COMMITTEE TO CONSIDER REVISION.

The National Joint Industrial Council for the Tramways Industry met at the Ministry of Labour on December 15 and considered the resolutions passed at the conference of municipal tramway authorities on December 9, and reported in our issue of December 15. One of these resolutions asked for the appointment of "a special committee to consider and revise as a matter of urgency the whole of the terms of the March 1919 agreement."

The employers' side of the Council intimated that they had no desire to interfere with the normal working week of 48 hours, and that the reports of an attempt to establish a 54-hour week were incorrect. They stated that difficulties had arisen from the guaranteed week of 48 hours, which in practice had been found inadequate to meet the varying needs of the efficient operation of tramways.

The trade union side pressed for adherence to the guaranteed week, and stated that only on that condition could they agree to remit to a committee for consideration and revision the other clauses in the agreement. They were, it is understood, opposed to a system of "spread-over" duties, even although the normal 48-hour week might still be recognised.

The following is the text of the resolution passed unanimously—

> "That, subject to the reservation that the normal working week shall consist of 48 hours, a special committee be appointed to consider the revision of the agreement of March 1919; the report of the special committee to be presented to the monthly meeting of this Council to be held in February 1922; any proposed revision of the agreement to be subject to the approval of the constituent employers and employees."

Upon the proposal by the employees' representatives that time and a half rates be paid to all employees called upon to work on Tuesday, December 27, it was resolved that the matter should be left to the decision of each individual undertaking.

Tramway companies, after careful consideration of the present position, gave notice on December 13 to terminate the agreement.

The full text of the agreement of March 1919 was given in full in our issue of April 10, 1919.

CORRESPONDENCE.

"THE TROLLEY-OMNIBUS."

To the Editor of THE TRAMWAY AND RAILWAY WORLD.

Sir,—With reference to Mr. C. B. Nixon's further letter appearing in your December issue, I am pleased to note a gradual weakening in his antipathy to the trolley omnibus, and that he now admits "that there are not a few special circumstances where the trolley omnibus might be indicated in preference to petrol omnibus." This admission is, however, qualified, "but I submit that these instances are extremely rare." Where electric power can be purchased in bulk for a sum not exceeding 2½d. per unit, and given a service of not less than 15 minutes, or, alternatively, with current at 1½d. per unit and say a 30-minute service, there is no petrol vehicle that can possibly operate so economically as the trolley omnibus. Would Mr. Nixon claim that instances of purchasing current at the above-mentioned rates are extremely rare?

With regard to Mr. Nixon's claim that trolley omnibuses cannot be overloaded, the most recent trolley omnibus in operation in this country, and having a seating capacity for 36 passengers, is carrying up to 65 passengers during rush periods of the day, and at an average cost for electric power of under 1d. per omnibus-mile. Does this not compare favourably with the petrol omnibus?

With regard to the speed of this type of vehicle, this is only limited by the size of electric motor as fitted, and the capacity of the generating station from which the electric power is obtained.

One has only to instance the speed of our electric railways, or London underground tubes, and to consider the alternative of driving such trains by means of petrol engines, in order to arrive at a conclusion regarding the capabilities of the electric motor in this respect.

Yours faithfully,

For CLOUGH, SMITH AND COMPANY, LIMITED,
N. CLOUGH, *Director*.

36 Victoria Street, Westminster, London, S.W.1,
December 23, 1921.

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ELECTRIC TRACTION IN CHINA.

By J. G. Smeaton
(*Late Deputy General Manager, Shanghai Tramways*).

With the eyes of the world centred on the epoch-making conference at Washington, it is inevitable that China—the crux of the Pacific problem—should be very much in the foreground at the moment. It is, however, perhaps not sufficiently realised, in this country, that if the conference succeeds in its efforts to achieve stabilised conditions in the Pacific, China, at present an important market, will almost certainly become one of the world's largest purchasers. The idealism of the United States in this connection coincides with her business interests, and just as soon as the present internecine troubles in China are adjusted—probably by sympathetic foreign intervention—a keener scramble than ever for new markets, under the latest "open-door" policy, will begin. The aim of this article, however, is not to deal with the trend of political happenings upon the general economic situation in China, but to try to indicate briefly the prospects of development of electric traction.

The writer was connected for fourteen years with the highly successful system of tramways operated in the foreign settlement at Shanghai, and perhaps a few particulars regarding that system may be read here with interest. The Shanghai Electric Construction Company, Limited, was formed in London in 1906 with a capital of £320,000 for the purpose of constructing and operating a system of overhead electric tramways in the foreign settlement at Shanghai under a concession granted by the Shanghai Municipal Council to Messrs. Bruce Peebles and Company, Limited, of Edinburgh—the latter firm subsequently carrying out the contract for the construction of the system. The lines, measuring about 16 miles of route—9 miles double track and 7 miles single track—were opened for traffic in March 1908, and the original equipment of rolling stock consisted of 65 motor tramcars of the single-deck type. The difficulties in the way of financial success in the early days of operation—the proverbial conservatism of the Chinese, unrestricted and cheap rickshaw competition, depreciated subsidiary currency, and the low earnings of the vast majority of the natives—seemed well-nigh insuperable. These difficulties, however, were gradually overcome, and the following figures indicate the remarkable progress which has been made under the able administration of the company's general manager in Shanghai—Mr. Donald McColl.

		1909	1920
Population (foreign settlement)		494,000	783,146
Length of track (route miles)		16¼	17¾
Rolling stock	motor tramcars	65	90
	trailer tramcars	-	85
	railless cars	–	7
	Total	65	182
Car-miles run		1,979,001	4,875,562
Passengers		11,772,715	110,833,311
*Total traffic receipts		Mex. $441,541	Mex. $1,820,273
Passengers per car-mile		5·95	22·73
Receipts per car-mile		Mex. cents, 22·31	Mex. cts., 37·33

The chief features of the policy which has produced the striking results revealed in the foregoing figures are (1) low fares to induce the poorly paid natives to travel—really *creating* a new traffic, and thereby securing a very high occupancy of the cars; (2) very frequent fare section points, necessitating short overlapping sections, to allow of passengers paying for the *exact* distance travelled—the Chinese, one and all, have very keen commercial instincts; and (3) the general introduction of trailer cars. Shanghai is quite flat, and particularly suited to trailer operation, no brakesmen being required.

In the month of July 1915, railless electric traction was introduced on about a mile of route in a narrow thoroughfare of dense traffic in the busy area, and this preliminary route has proved an unqualified success in every way. At the company's annual meeting in May 1920, the general manager, who was then in London, stated, "In railless electric traction, as we have developed it, on a mile of very busy route which we have had in successful operation for some years, there is a system which has proved its complete suitability for more general use in Shanghai for both passenger and freight services." Negotiations are now in train with the Municipal Council regarding an application by the company for powers to carry out considerable extensions of the railless system, and these proposals, which cover about twenty miles of route, include the handling of freight traffic in addition to passenger services. The company, which is now in a sound financial condition, paid dividends of 20 per cent. on its original capital of £320,000 in respect of the years 1919 and 1920, and early last year a distribution was made of fully paid bonus shares of £10 each in the ratio of one new share for every four shares held by shareholders, bringing the capital of the company up to £400,000.

China, with its teeming millions, offers vast possibilities for the introduction of electric traction—in view of Shanghai's experience probably railless electric traction would be the most suitable form—and it is almost unbelievable, for instance, that the capital city of the Republic possesses no modern system of public transit commensurate with its size and importance. Peking, to the professional eye, simply "pleads" for such a system, with its busy native life and its wide and straight main thoroughfares. This latter condition, unfortunately, is the reverse of what one usually finds in China, but the Chinese are realising more and more the necessity for wider streets in their cities. When I left China, over a year ago, Canton, in the south, was being reconstructed to permit of the introduction of a system of modern traction, and the reconstruction of Hankow, on the Yangtsze, was in hand when the war broke out in 1914. Another sign of the times was the tearing down, a few years ago, of the wall surrounding the Native City at Shanghai to make way for the construction of a wide thoroughfare.

From the statements of members of the American group in the Chinese banking consortium (made while visiting China during recent years), it is clear that applications for loans for constructive purposes required by the Provincial and Central Governments will be sympathetically received by the consortium. This is as it should be, and the success of the Washington Conference—at the moment most promising—would certainly hasten, as already mentioned the bringing about of an improved political situation in China, and the development of a healthy economic outlook. It should be borne in mind that China, with her vast industrious population and her practically untapped natural resources, is probably further from insolvency

* The present value of a Mexican Dollar is about 2s. 6d.

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to-day than any other nation in the world. The march of events in China may be more rapid than most of us imagine, and Japan's meteoric rise to a position of importance among the great nations is perhaps not without its lesson.

The electrical industry, like all other industries in Great Britain at the moment, is suffering from the loss of foreign markets, but I am enough of an optimist to believe that British ability and enterprise are still realities, and that they will not be found wanting when world conditions again become propitious. In this brief article I have merely tried to show that, in the coming great effort to increase our exports, it would be well for us to "Keep an eye on China."

LONDON & HOME COUNTIES ELECTRIC SUPPLY.

REPORT OF THE COMMISSIONERS.

The Electricity Commissioners have issued their decision (as was briefly stated in our issue of December 17) on the schemes submitted to them for the reorganisation of electricity supply in the proposed Home Counties district. In issuing a summary of the proposals, the Ministry of Transport mention that the decisions have been taken by the Commissioners after consideration of the evidence given at the inquiry held last June and July. The main points are as follow—

(1) The provisionally determined district is confirmed, subject to a few minor modifications.

(2) A Joint Electricity Authority is to be established for the district upon the lines proposed in the schemes promoted by the London County Council and the conference of local authorities owning electricity undertakings.

(3) The Commissioners concur generally in the engineering proposals submitted for dealing with the requirements of the district during the *first* stage terminating about 1925-1926. These involve some extensions of existing plant and the grouping of stations, so that the fullest use may be made of plant which will amount by 1925-1926 to 633,000 KW. in all.

(4) For developments beyond the first stage, the Commissioners have evolved a modified scheme which shows substantial savings over the schemes submitted. This involves the erection of a well-placed riverside station or stations where facilities for condensing water, coaling, etc., can be easily obtained. The first capital station is to be on the Barking site, which the County of London Electric Supply Company, Limited, have acquired, and on which they are prepared to begin immediately the construction of a 100,000 KW. station. The company can be called upon before August 1926 to sell this station to the Joint Authority on terms to be prescribed.

(5) The expected economies cannot be effected unless there is inter-communication of the principal generating stations in the area, combined with the pooling of the available plant. Excluding stations owned by power companies, only some 12 to 14 stations will ultimately survive as generating stations, and these should vest in the Joint Authority. The remainder, of which about 50 will be gradually closed down, can be incorporated in the scheme under an appropriate system of control. Negotiations as to terms of transfer of generating stations to a Joint Authority are in progress.

(6) The North Metropolitan Electric Power Supply Company and the Metropolitan Electric Supply Company are to have delegated to them the supply powers of the Joint Authority in their respective areas.

(7) The authorised undertakers should finance all extensions of generating plant at their stations while such stations remain in their possession, and any inter-connecting mains required before the Joint Authority is in a position to act. The Joint Authority should raise any necessary capital thereafter.

The Commissioners point out that the proposals of certain railway companies to proceed with the electrification of their suburban lines constitute an added reason for reorganising the supply and constructing a capital station at an early date. They do not hold the view that a Joint Authority would be unable to generate more cheaply than a railway company owning its own generating station, and consider that a combined supply from a common source would be advantageous to both parties.

An Appreciable Saving.

The Commissioners express gratification that a large measure of agreement has been arrived at between the promoters of the three principal schemes submitted. All the parties to these schemes agree that an improvement in the present position is urgently needed, and that a Joint Electricity Authority, representative of all interests, should be established without delay to carry out the necessary reorganisation. The duties which will devolve upon the Joint Authority under the scheme which the Commissioners will approve will be such as can be efficiently administered over a wide area. These duties will broadly involve the acquisition or control of generating stations for the purpose of pooling the generating plant and for the more economical operation of the stations in the whole district, leaving local distribution to authorised distributors. In the Commissioners' opinion the Joint Authority should consist of 26 representatives (or 27 if the chairman is elected from outside), allocated as follows—Local authorities, 8; companies, 8; London County Council, 6; other County Councils, 3; railway companies, 1.

Alternative schemes were submitted for meeting anticipated developments in the period beginning in 1925-1926, involving capital expenditure in the one case of £9,750,000 and in the other of £23,855,000. The scheme adopted by the Commissioners will need practically no more new capital expenditure than the continued extension of the group stations. Further, as compared with the estimated annual cost of electricity supplied to authorised distributors, namely, £7,262,700, or 1·147d. per unit, under one of the schemes submitted, the Commissioners' proposals should enable electricity to be delivered at a cost of £6,190,700, or 0·978d. per unit, an annual saving of upwards of £1,000,000, or 15 per cent., with all the advantages derivable from a capital station, such as availability for large railway or other supplies in bulk at favourable rates.

With regard to the acquisition or control of generating stations, the Commissioners note that there is a large measure of agreement among those concerned, and they are of opinion that it should be possible to settle terms of transfer on a basis equitable to local authorities and companies alike, which would be neither unduly burdensome to the Joint Authority nor adverse to the interests of the consumers of electricity.

The Commissioners will embody their decisions in a draft order, which will be the subject of a further inquiry, as provided by the Act of 1919.

London County Council's Opinion.

In view of the decision of the Electricity Commissioners that the first capital station should be erected at Barking by the County of London Electric Supply Company, the London County Council have urged on the Commissioners the need for safeguarding the public interests in any conditions they may attach to their consent. In a letter addressed to the Commissioners on December 16, the clerk of the Council pointed out that the matter had become of special importance by reason of the fact that under the County of London Company's Act of 1921 certain provisions were laid down to govern the terms upon which the Barking supply might be purchased by a Joint Electricity Authority or other body. Further, under the Act the terms of purchase were to be laid down as part of the conditions of consent by the Commissioners to the work proceeding.

> "In these circumstances" (the letter continues), "the Council wishes again to urge very strongly upon the Commissioners the importance of safeguarding any consent which may be given with such conditions as will adequately protect the interests of the public and preserve the position of the Joint Authority or other purchasing body. With regard to the suggestion made in the Council's letter of August 13, 1920, that any consent which might be given should be limited to such works as were necessary for the company's own requirenemts, I am to press upon the Commissioners that no action should be taken at this stage which will have the effect of tying the hands of the Joint Authority as regards the future electricity development of the London area. As regards the question of the authority to be designated as the purchasing authority, I am to suggest that the Commissioners in giving their consent should have regard to the possibility of no Joint Authority having been set up under the provisions of the Act of 1919 by the date at which the purchase powers will expire, and that provision should, if possible, be made in the consent for some other defined authority to have alternative rights of purchase."

Need for Railway Electrification.—Sir Philip Dawson, M.P., speaking in London on December 20, said the total cost of the electrification of various railways would involve an outlay of at least one hundred millions sterling, and of the total about 75 per cent. would be paid in wages. If the three most urgently needed electrification schemes around London were begun, as was quite possible, within the next few months, there would be between thirty and forty millions of money spent in a period of from four to five years, and those schemes would employ from 40,000 to 50,000 men, mostly of the skilled type. He did not favour general standardisation in the carrying out of electrification.

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COST OF EDINBURGH ELECTRIFICATION.

CITY TREASURER'S FAVOURABLE REPORT.

The financial aspect of the proposed electrification of the cable tramways of Edinburgh Corporation is dealt with in a report prepared by the City Chamberlain (Mr. R. Paton), at the request of the Tramways Committee. After quoting figures relating to the total capital expenditure on the existing tramways, he says that since 1896 or thereabouts the tramways undertaking has redeemed over £1,000,000 of debt, and this is comparable with the additional liability of about £750,000 which an entire conversion to overhead electric tramways would render necessary.

The report proceeds to suggest a system by which the outstanding debt on the cable system (£372,000) should be dealt with in view of the electrification. Mr. Paton proposes that this debt should be divided between the old cable system, converted electric system, and motor omnibus system, and that the division should be roughly on the following basis—£150,000 to old cable system, £200,000 to converted electric system, and £22,000 to omnibus system.

The City Chamberlain goes on to say that the estimate by the tramway manager (Mr. R. S. Pilcher) of the cost of electrification is £648,711. He takes the present statutory period of 30 years for redeeming this expenditure, and on the *annuity* system (which means a uniform burden for sinking fund and interest during the whole period, whereas the *instalment* system means a heavier burden in the first years of the period, but a lighter burden thereafter) finds that it means an additional annual burden of £44,635. Against this, however, he points out that there will be a saving in the working expenses of the electric system, as compared with the cable system, of about £98,000 per annum. The net saving he accordingly puts at £53,365, which, he says, will be available to meet renewals and provide reductions in fares. Some consideration must be given to the number of years over which the debt for capital expenditure should be redeemed. The maximum statutory period at present authorised is 30 years. This is in operation for the £200,000 proposed to be allocated to electric. As regards the £97,000 incurred, or to be incurred, since the Corporation assumed the management of the undertaking, and also the £648,000 estimated by the tramway manager, the period for redemption of this expenditure should, in his opinion, be 25 years. With regard to the method to be adopted for repayment of the debt, Mr. Paton has no hesitation in recommending that the instalment system be adopted.

"A CONSIDERABLE SAVING."

The City Chamberlain alludes to the fact that the debt charge on the electric as compared with the cable system would show an increase of fully £30,000, and points out that there is an important set-off to the increase in debt charge. As pointed out in the tramway manager's report, the cost of working "cable" is now much greater than that of "electric." There would accordingly be a very considerable saving in working expenses if the conversion to electric is carried out. He puts this saving on the basis of last year's experience (Edinburgh cable and Leith electric) at 4·2d. per car-mile, or £98,000 per annum. If the debt charge be excluded in each case, as he thinks it should be, for a comparison of this kind, the difference in the working costs of the two systems was last year as much as 5½d. per car-mile, equivalent to £128,000 per annum. Last year, however, was somewhat exceptional. In a normal year the saving may be put at probably not less than from £50,000 to £60,000. This would, of course, be far more than the sum required as a set-off to the additional debt charge. It would accordingly appear that if it is decided to proceed at once with the electrification of the whole cable system, the financial result, so far as that is affected by additional debt charges based on the figures submitted, will be quite satisfactory.

REPORT ON BURTON TRAMWAY ACCIDENT.

Burton-on-Trent Tramways Committee have issued the report of Major Mount, the Ministry of Transport's inspector, on the overturning of a tramcar in Station Street on November 3 (as reported in our issue of November 5). A number of passengers were injured, though not seriously. The report stated that when at the facing points leading from the single to the double line the leading wheels took the left-hand track and the trailing wheels followed the right-hand track. All the wheels finally left the rails on which they were travelling, and the car then skidded and overturned. The body and truck were not seriously damaged, but the trailing axle was broken. The motorman estimated his speed at nearer four than five miles an hour, but the inspector formed the opinion that it was probably six miles an hour. It was impossible to say definitely when the axle broke, but he agreed with the Corporation officials that the fracture took place at or just before the car reached the points. Having referred to the bad record of axle fractures, to which the Corporation was fully alive, and the constant shocks received (as pointed out by the Corporation's electrical engineer, Mr. T. Hall) during the passage of cars over the street railway crossings, the inspector said it was clear that either the efficiency of manipulation in regard to the speed in which cars are being driven in Burton had depreciated since the war, or else axle material was not as good as it used to be. It was evident there was a tendency to exceed the permissible speed limit. It was important that restrictions through junctions, round curves, and over level crossings should be strictly observed by the inspection staff, not only in the interests of safety, but having regard to the maintenance of rolling stock. His opinion was that even though derailed, the car would not have overturned had the speed through the junction not exceeded four miles an hour. As to the quality of the axle steel, the inspector thought that having regard to the pre-war record of failures, it must be admitted that the material was not so good as it used to be, and the Corporation would be well advised to pay particular attention to this important question from the safety point of view. It would be advisable to insist upon, and, if necessary, in the case of small orders, to pay for the usual tests before purchase, and in this connection the inspector drew attention to the British Engineering Standard Association's recent specification for tramway axles (August 1921).

The Tramways Committee have informed the Minister of Transport that the question of broken axles was receiving careful consideration, and that steps were being taken to ensure that motormen did not exceed the maximum speeds authorised.

RAILWAY ARCHITECTURE.

INTERESTING EXHIBITION AT EUSTON STATION.

An exhibition was recently held at Euston Station, London, of drawings and designs executed by the architectural staff (chief engineer's department) of the London and North Western Railway. Its object was to promote interest in architecture and art generally, especially among those responsible for the design of railway premises such as stations and offices. The work on view was selected from that done privately by the staff in pursuance of their studies, and many of the drawings had gained awards in various competitions, including those of the Royal Academy.

Mr. E. C. Trench (chief engineer to the company), in declaring the exhibition open, said it was not intended as an advertisement for the architectural staff, but was an effort by them to encourage their colleagues and friends to take a little more interest in architecture than they were doing already. Nothing added more to the interest of travelling than some knowledge of the buildings—such as churches and old houses—which were seen as one went about. To take an interest in architecture tremendously enhanced the pleasure of travelling. Mr. Trench went on to refer to the manifold activities of such a man as Sir Christopher Wren, and pointed to some of the outstanding works of his life (including St. Paul's Cathedral, with its 10,000-ton dome) as instances of the attractive field of study that lay before the architectural student. Proceeding, he mentioned humorously that at Euston they all lived in watertight compartments, and no one knew what his next-door neighbour was doing. They had, however, some "live architects" up there, and the work now on view was not done for the company, but in the staff's own spare time, with a view to qualifying not as mere architectural draughtsmen, but for the status of properly skilled architects. On the whole they had presented a very pleasurable show. (Applause.)

Lieut.-Colonel Cortez Leigh (chief electrical engineer to the company) proposed a vote of thanks to Mr. Trench, and this was heartily endorsed. In the course of his remarks he complimented Mr. R. Wynn Owen (architect) upon the London and North Western Railway War Memorial, which has been erected to his design in Euston Square, and said it was generally agreed that this monument was one of the best of its nature raised to the memory of those who fell in the war.

The drawings on view revealed a high level of merit. In the case of original creative work for buildings on a large scale, one was impressed by the spacious conception and dignity of some of the designs. The exhibitors were as follow—Messrs. R. Wynn Owen, A.R.I.B.A. (chief architect); W. H. Hamlyn, A.R.I.B.A.; H. J. Davies, M.S.A.; H. Holland, A.R.I.B.A.; W. H. Jackson, W. J. Waterman, and S. Honour, M.S.A. The last set of drawings prepared by the late Captain James Norquoy, who fell in action in 1917, were on view, and there was also a model of the L. and N.W. War Memorial, prepared by the sculptors.

Price of Steel Bars Reduced.—The South Wales Siemens Steel Association have decided again to reduce the price of steel bars by 7s. 6d. a ton, making the price £7 7s. 6d. a ton. During the war steel bars fetched £30.

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SIR JOHN TIMPSON, K.B.E.

The inclusion of Councillor John Timpson, deputy mayor of Portsmouth and chairman of the Portsmouth Corporation Tramways Committee, in the list of New Year Honours, is specially gratifying to his friends in the tramway industry. Councillor Timpson was three times Mayor, and filled other civic offices with much credit. He represented the Corporation during the important years following the war, one of his duties being to announce from the Town Hall the signing of the Armistice. He received many distinguished visitors, and among his guests at Portsmouth from time to time have been the officers and men of the Brazilian squadron and the Japanese squadron. He received the Crown Prince of Japan, and the Prince of Wales on his return from Canada and America in

Sir John Timpson, K.B.E.
(Chairman of Portsmouth Corporation Tramways).

December 1919, and again in October 1920, on the Prince's return from Australia. During the war he raised £850,000 for the last Victory Loan, and concluded three years of energetic work by seeing the war memorial through to its completion. For this scheme, including £10,000 set apart for the hospital, he raised over £30,000.

As chairman of the Portsmouth Corporation Tramways, he has for many years taken a prominent part in the industry, and in 1920 he was appointed a member of the Council of the Municipal Tramways Association, and at the Salford conference last September he was elected vice-president. Some time ago Councillor Timpson received the Japanese Order of the Knight of the Sacred Treasure.

MIDDLESEX TRAMWAYS AND ROADS.

In his annual report, the Middlesex county surveyor says there are many unsatisfactory lengths of road in the county, due to difficulties in obtaining suitable materials even for ordinary maintenance, while improved surfacing to meet the changed conditions of traffic has only been possible on a very restricted scale. One of the main difficulties in the way of improvement is the bad condition of many of the tramway tracks. Until these can be reconstructed—which for financial reasons is likely to be a slow process—the haunches cannot be dealt with in a satisfactory way. The increase in traffic has rendered waterbound macadam uneconomical and most difficult to maintain. Unfortunately Middlesex has several miles of waterbound macadam haunches to tracks, which are hard to maintain if surfaced differently to the track, as heavy traffic causes trouble at the dividing lines of the varying surfaces. A counsel of perfection would be to pave the whole of the tramway haunches with wood on reinforced concrete when the tracks are reconstructed. In the meantime it would be advisable to substitute slag tar macadam or some bituminous material for the waterbound haunches.

FINANCIAL REPORTS AND MEETINGS.

PINCHIN, JOHNSON AND COMPANY, LIMITED, have declared an interim dividend of 5 per cent., less tax.

EAST KENT ROAD CAR COMPANY have announced a dividend at the rate of 10 per cent. per annum for the year ended September 30, 1921.

OMNIBUS LOSSES AT LINCOLN.—A loss of £1,900 has been incurred on the Lincoln omnibus services for the half-year ended September 30.

A.E.G.'s DIVIDEND.—At the general meeting of the A.E.G., held in Berlin on December 20, a dividend of 16 per cent., as against 14 per cent. last year, was declared on the ordinary shares.

LOSS ON DARLINGTON TRAMWAYS.—There was a net loss on the Corporation tramways for the year of £3,166, compared with £3,744 last year, in spite of the fact that the revenue had increased.

S. SMITH AND SONS (MOTOR ACCESSORIES), LIMITED.—The accounts for the past year show a loss of £295,437, and the surplus brought forward was converted into an adverse balance of £203,985.

SHANGHAI ELECTRIC CONSTRUCTION COMPANY.—A second interim dividend at the rate of 6 per cent. actual (12s. per share), less tax, in respect of the year 1921 has been declared, payable against presentation of coupon No. 18 on and after February 1, 1922.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS COMPANY.—The directors have decided to pay a final dividend of 3 per cent., less income-tax, being at the rate of 6 per cent. per annum, on the 6 per cent. cumulative preference shares for the half-year ending December 31, 1921.

COVENTRY CHAIN COMPANY.—The profits of this company for the year ended August 31, 1921, were £35,546, and £8,222 was brought forward. The directors recommended a final dividend of 7 per cent. on the ordinary shares, making 10 per cent. for the year, less tax, placing to reserve £8,344, and carrying forward £9,386.

MORECAMBE TRAMWAYS COMPANY.—The year's working showed a profit of £1,255, or an increase of £448 on the previous year. The cars travelled 53,070 miles, or 1,967 more than last year. The number of passengers carried was 577,616, a decrease of 3,550. A dividend of 3 per cent. (half per cent. more than that for the preceding year) is being paid.

WARRINGTON CORPORATION TRAMWAYS.—The accounts for the half-year ended September 30 show a net loss of £200, as against £248 for the corresponding period in 1920 on the tramways, and a net loss of £209, as against £569, on the omnibuses. The assessment of the undertaking has increased from £1,429 in 1914 to £6,724 in 1921. The increase in rates alone was £5,295.

NATIONAL OMNIBUS AND TRANSPORT COMPANY.—The directors have recommended that no dividend be paid for the year ended October last. The profits show an increase of nearly £7,000, the amount being £26,900, as against £20,100 for the year preceding, when a dividend of 8 per cent., less tax, was paid. Including a sum of £7,700 brought forward, there is a total available of £34,600, of which £15,000 is to be transferred to depreciation of rolling stock, leaving £19,000 to be carried forward.

FERRANTI, LIMITED.—The net profit for the year ended June 30 last was £36,268, and including £89,462 brought in, the amount available is £125,730. The sum of £100,000 has been transferred to general reserve, and there is a balance of £25,730. Out of general reserve, amounting to £172,000, it has been decided to write down the value of goodwill and patent rights, leaving the reserve at £102,630. The directors recommended a dividend of 18 per cent., less tax, being three years' arrears on preference shares. It is stated that there was a serious falling off in orders during the beginning of 1921, which will materially affect the next financial year.

CORDOBA LIGHT, POWER AND TRACTION COMPANY.—Sir George A. Touche, Bart. (chairman of the company), presided at the annual meeting in London on December 20. In reviewing the present position and prospects of the company, he said they ought to electrify the horse tramways which they took over more than a year ago, as well as make certain extensions of the electric lines. In regard to the tramways company, the figures showed a decided improvement during the year. The increase in gross receipts in 1921 over 1920 was £25,603, or over 32½ per cent. The expenses increased by £12,310, or 23½ per cent., a not unreasonable increase when the larger traffics and the high price of materials and labour for maintenance were considered. No cash was available for the payment of dividends earned on the preference shares, and this had made it necessary to deal with them under a scheme of arrangement.

CARDIFF CORPORATION TRAMWAYS.—At a meeting of Cardiff City Electric Light and Tramways Committee on December 16 (Councillor Sydney Jenkins presiding), Mr. Allcock, the City Treasurer,

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reported that the traffic receipts of the tramways for the past year amounted to £290,890, as against £278,383 for the previous year, an increase of £12,507. The parcels service had earned £907, as against £838 for the previous year, an increase of £69. Advertising on the cars brought in £2,240, which was an increase, compared with 1919-20, of £628. The excess of expenditure over income for the year ended March 31, 1921, was £8,533. The depreciation fund at the date already given was £108,988, whilst the loan liability of the undertaking at the same date was £878,321, the net liability being £415,490. With regard to omnibuses, six had been purchased at a total cost of £12,812, excluding the cost of tyres, and the service was started in December, 1920. Up to March 31, 1921, there was a deficit on their running of £1,096. Mr. R. L. Horsfield (tramways manager) reported that the deficit on the tramways in a great measure was attributable to the increase of wages. Operating costs for the year came out at 19·76d., which in comparison with 23 similar undertakings in the country was very good. The average working costs were 20·296d. per car-mile.

Belfast Corporation Tramways.—The accounts for the six months ended September 30 last showed that the receipts amounted to £334,138, and the expenditure, including capital charges and depreciation (together with the proportion of the deficit from last year, £19,818) amounted to £356,569, involving a loss of £22,431. The expenditure shows an increase of more than £20,000 as compared with the same period of 1920. Councillor Turner (chairman of the Tramways Committee), in moving the adoption of the minutes in the City Council, pointed out that the actual net deficiency for the half year, after allowing for the portion of last year's deficit, was £2,613. Had it not been for the abnormal increase in the cost of power, viz., £13,266, the higher standing charges could easily have been met, and a useful surplus obtained which would have enabled the committee to reduce last year's deficit by a reasonable amount. Although the position of the undertaking financially was not all they could desire, yet having regard to all that it had had to contend with, such as curfew restrictions, unemployment, and unrest in the city, he felt sure the Council would agree that the net result of the six months' working might have been very much worse. As it was they were in a better financial position to the extent of £10,901 than for the corresponding period in 1920, the deficiency for that term being £13,514.

Cape Electric Tramways, Limited.—The annual meeting of this company took place at 1 London Wall Buildings, London Wall, E.C., on December 14. The accounts for the year ending June 30 show a profit of £81,724, and after providing interest on, and redemption of, debentures, and bringing in the balance from last year, there is a disposable balance of £60,046. The reserve fund has been increased by the sum of £18,000, leaving a balance of £42,046, out of which the directors recommended the payment of a dividend of 6 per cent. on the ordinary shares, absorbing £29,473, leaving a sum of £12,573 to be carried forward. The total number of passengers carried during the year was 29,773,587, an increase of 3,851,958. The traffic receipts amounted to £397,124, as against £325,085, or an increase of £72,039. The capital expenditure during the year was £70,620, including the cost of the new rolling stock at Cape Town and the new engine and generator and small extensions of track at Port Elizabeth. After long negotiations the Cape Town municipality had decided not to proceed with their proposal for the acquisition of the Cape Town system, and the concession will now run until 1925, when the Council have again the right to purchase. The Board expressed their appreciation of the services of Mr. W. F. Long, general manager at Cape Town, and Mr. W. H. Fremantle, general manager at Port Elizabeth, and respective staffs.

Brown Bayley's Steel Works.—Including the balance brought forward from the previous year, and after deducting the interim dividends paid on the ordinary shares and the preference shares to June 30, there was a balance of £29,456, which had been appropriated as follows—Preference dividend for two months ended August 31, £4,166, final dividend of 2½ per cent. on the ordinary shares, £5,250, carrying forward a balance of £20,040. To enable the company to take advantage of the provisions of the last Finance Act as to stock valuation for the purpose of excess profits duty to date, the stocktaking was altered from July 31 to August 31, but it is the intention of the Board to adopt July 31 as the date in future. At a meeting of the company Mr. Robert Armitage, M.P., chairman and managing director, said that the next accounts would cover a period of only seven months. As a result of the decision of the Government in regard to excess profits duty, they hoped to improve their financial position by making application for the return of money paid instead of paying more. Like other concerns, they were suffering from the general trade depression, and as regards the future it was very difficult to hold a fair balance between optimism and pessimism He did not think trade was going elsewhere; it was non-existent. People would not buy on falling markets, which had not reached the end as yet. An improved feeling would make people more inclined to launch out into industrial schemes. Mr. W. R. Mainprice, in proposing approval of the interim dividends, said that they had just passed through twenty months of difficulty as great as any the company had experienced. There were, however, bright spots. They had now produced a stainless iron, and were certain that they could deliver the goods.

CONTRACTS AND ORDERS.

Leeds Corporation Tramways have received a No. 5 "Celerity" rail grinder from the Equipment and Engineering Company.

Brown, Bayley's Steel Works, Limited, are to have an order for 100 driving wheel tyres and 25 pony tyres from Blackpool Tramways Committee.

Bolton Tramways Committee have accepted the tender of the English Electric Company, Limited, for tramcar equipment and spare parts.

Salford Tramways Committee have recommended the acceptance of the tender of Hadfield's, Limited, for Hadfield's patent steel switches, open mates, and crossings.

The Swedish East Coast Railways are stated to have ordered from the Rhenish Steel Works Company steel rails sufficient to cover their demands for the whole of 1922.

Bloemfontein Town Council are to spend £18,000 on the purchase of five new railless cars and other purposes connected with the railless system. This is in addition to the three other cars now on order.

Edinburgh Corporation Tramways have placed an order with the Equipment and Engineering Company, of 2 Norfolk Street, London, W.C., for an improved "Simplex" rail jack and carrier, for transporting 60 ft. rails.

Electric Welding Plant for Aberdeen.—The Corporation Tramways Committee of Aberdeen have sought tenders for an electric welding plant at about £600. They also propose to erect two additional shelters at a cost of £182 each.

The Titan Trackwork Company, Limited, of Rutland Works, Sheffield, have received contracts for the supply of Titan manganese steel points, crossings, and special work for Leeds City Tramways and for Plymouth Corporation Tramways.

The London County Council have accepted the tender of the Anderston Foundry Company, Limited, for 1,000 yokes required in connection with the conversion from the side slot to the centre slot system of the tramways in Kingsland Road.

Bradford Tramways Committee have recommended acceptance of the following tenders—The British Insulated and Helsby Cables, Limited, for copper rail bonds—500 at 3s. 2d. each, and 1,000 at 2s. 9d. each, and Crossley and Davenport for one ton of mild steel cotters at £36.

The Acme Flooring and Paving Company, Limited, are the successful tenderers to the London County Council for the supply of 140,000 creosoted deal paving blocks required in connection with the reconstruction of the tramway tracks in Paddenswick Road, Hammersmith. The price delivered at the wharf was £18 10s. per thousand. Eleven tenders were received.

The Victorian Electricity Commissioners, at Melbourne, Australia, have accepted the tender of Messrs. J. Thompson, Wolverhampton, for the complete steam-raising plant at the Morwell power-house at a cost of £282,000, of which £137,000 is to be expended locally. For the supply of steel work the tender of Redpath, Brown and Company (£115,000) has been accepted.

Aberdeen Tramways Committee have authorised the purchase of a welding plant from either the Metropolitan-Vickers Electrical Company or the Equipment and Engineering Company. The price will be between £300 and £350. They also authorised the purchase of a re-conditioned chassis from Messrs. J. I. Thornycroft and Company, to be used as a lorry, and also in connection with welding.

Sandberg "In Situ" Rail Hardening Process.—The Scholey Construction Company, Limited, 56 Victoria Street, London, S.W.1, have secured contracts for the "in situ" treatment of track for the Hastings Tramways Company and the Cardiff Corporation Tramways. The Scholey Company are now executing contracts on tramways at Leeds, Wallasey, Liverpool, Hastings, and Cardiff.

Aberdeen Corporation Tramways Committee have recommended acceptance of the following tenders for permanent way renewal—Rails—A. M'Bean and Sons, Wolverhampton (£12 17s. 6d. per ton); fish-plates—A. M'Bean and Sons (Wolverhampton (£15 17s. 6d. per ton); fish-plate bolts and nuts—Norton and Son, Darlaston (£24 per ton); tie-bars—W. Bain and Company, Coatbridge (£19 per ton); anchor bolts—J. and C. Murray, Glasgow (£32 per ton); chilled blocks—Barry, Henry and Company, Aberdeen (£12 3s. 9d. per ton).

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

TRAMWAY DEVELOPMENT SCHEME.

The Corporation, in a Draft Provisional Order, seek powers to construct additional tramways, a new street or road, and to borrow further money for street works and the extension of the Esplanade, and for the tramway and gas undertakings. It is pointed out that the Corporation, having acquired the lands known as the Hazelhead estate, adjacent to the city, find it expedient to extend the tramway service from Rubislaw terminus to the Hazelhead estate. The new undertakings are estimated to cost £620,000, of which £174,500 will be expended on the construction of the tramways and tram road, the acquisition of lands, and electrical equipment; £170,000 for the erection of buildings and plant for gas works purposes; £30,000 in connection with the provision and running of omnibuses; £50,000 for the construction of buildings in connection with the tramway undertaking; £50,000 for repairing and recausewaying existing streets and laying out new streets within the city; and £39,000 for the extension of the Esplanade.

BIRKENHEAD.

IMPROVEMENTS DEFERRED.

The Tramways Committee have decided not to proceed with the work on certain tramway routes which was intended to provide work for the unemployed. The estimated expenditure was £99,800, and this sum has been found too large to permit of a remunerative investment, as repayment was required in eight years.

BRADFORD.

TRACK RENEWAL—EXTENSION DEFERRED.

The Tramways Committee propose to apply for sanction to borrow £450,000 for track renewal. The committee have found it necessary, on financial grounds, to defer an extension of their system from Bailiff Bridge to Brighouse, as desired by the Brighouse local authority. Halifax Corporation tramcars have hitherto served Brighouse, but the former's lease has expired.

BRIGHTON.

REVERSION TO PENNY FARES.

The Town Council resolved that in view of the continued decreasing income from tramway fares, it was advisable that penny fares stages be tried for three months from January 1 last. The former minimum was 2d.

CHESTER.

OPERATION OF TRAMWAYS TO BE CONTINUED—OMNIBUS SERVICES PROPOSED.

Mr. A. R. Fearnley (general manager of Sheffield Corporation Tramways) has reported on his examination of the Chester Corporation system, with a view to advising on the relative merits of (1) putting the track in order and continuing to work the tramways on similar lines to the present; (2) taking up the track from the Castle to Saltney and providing in lieu a service of omnibuses or railless cars; (3) obtaining tenders for leasing or purchasing of tramway system; (4) inviting tenders for omnibus services. Mr. Fearnley recommends that the tramways be maintained as at present laid out. The work which requires to be put in hand in order to allow the undertaking to be continued would not be expensive, and could easily be met out of the existing renewals, which in March last amounted to £17,539. Discussing the question of omnibus services, Mr. Fearnley states that the municipality should carefully consider the question of extending the present tramway services by instituting omnibus services in connection with the tramcars. The Tramways Committee have decided to recommend the Corporation to maintain the tramways as at present laid out, and to proceed at once to deal with this question on the lines which are likely to cause the city the least financial loss, and at the same time enable them to retain in their own hands the control and operation of the system.

DOVER.

PROPOSED RAILLESS TROLLEY SCHEME.

The Corporation Tramways Committee, after hearing a report by the general manager (Mr. E. H. Bond), decided to apply for a provisional order to authorise the introduction of railless trolley cars in the town.

GLASGOW.

WAGE REDUCTIONS—AIRDRIE TRAMWAYS PURCHASED—THE PAISLEY PROBLEM—NEW BRIDGE.

The Corporation tramway employees accepted the recommendation of the Corporation Wages Committee of a further reduction of 3s. per week, to be made from the first full pay in December in the case of motormen, conductors, shed employees, and permanent way men, and 1s. 6d. per week in the case of female employees and boys under 18 years of age and non-able-bodied employees, on condition that the difference of 1s. as compared with the national agreement be d ducted from any further reduction at the end of January. The Council on December 9 accepted the recommendation of the Tramways Committee that the Corporation should exercise from December 19 the powers of the Airdrie and Coatbridge Tramways Trustees, by working the tramways in the two burghs, and that on the completion of the city extension from Baillieston to Coatbridge they should take over and work the system of the burghs as part of the Glasgow tramway undertaking. The purchase price is £82,250. The Tramways Committee recommended the City Council to purchase the undertaking of the Paisley District Tramways Company at a price of £200,000. A special sub-committee had previously recommended a price of £250,000. At a meeting of the Council it was intimated that the former sum was an impossible one from the company's point of view, and Baillie M'Whirr, the convener, asked the Corporation to remit the whole matter to the Tramways Committee for further consideration, and after some discussion this was done. The Town Council have resolved to proceed with the erection of a new bridge over the Clyde in line with Oswald Street. The Tramways Committee have agreed to pay half the cost.

HALIFAX.

PENNY FARES RESTORED.

A return to the penny minimum fare has been made on the Corporation tramways.

HULL.

TRAMWAY EMPLOYEES' NEW CLUB.

A club for the use of the Corporation tramway employees' Social and Recreation Society's Club has been opened in a room over the Osborne Street power-station. Mr. E. S. Rayner, the tramways manager, is president.

LEEDS.

MORE STANDING PASSENGERS.

At the City Council on January 4 a resolution was carried that 12 persons—instead of 8 as at present—in excess of the seating capacity be allowed to stand inside the tramcars. Alderman R. A. Smithson (chairman of the Tramways Committee) said the object was to regularise a practice that was already fairly general. Some conductors now filled their cars at rush times, while others adhered to the regulations, and allowed only eight excess passengers. The resolution would remove misunderstanding. He repudiated the suggestion that any of the Leeds cars were unsafe. From the accident point of view Leeds tramcars had the lowest possible average of costs in respect of accidents.

LIVERPOOL.

TRAMWAY EXTENSIONS DEFERRED—"SHOPPING" TICKETS.

The meeting of the City Council called for December 21 to consider an important scheme of tramway extensions was abandoned owing to the absence of a quorum. It is understood that the effect will be to defer the plans for at least a year. The overhead electric railway is issuing "shopping" tickets between the Dingle and the Pierhead and intermediate stations. The fares represent a reduction of 14 per cent. on first-class and 27 per cent. on third-class tickets

LONDON.

PROPOSED 1½D. FARES—AWARDS TO EMPLOYEES—INSPECTORS' PAY—ROUTE MAP—THROUGH RUNNING TO WIMBLEDON?—SPEED LIMITS—WAR MEMORIAL.

At the meeting of the London County Council on December 20 the Highways Committee reported that they had considered the resolution passed by the Council, on the motion of Mr. J. D. Gilbert, to consider and report as to the institution of a 1½d. fare for approximately 1·8 miles. The general manager reported, however, that the risk of loss of revenue if 1½d. fares were introduced would amount to a large figure, and that the issue of a 1½d. ticket would necessitate the issue of 2½d., 3½d., and 4½d. tickets, involving additional expense in printing, etc., and reduced efficiency in fare collection. Having regard to the probable heavy loss of revenue the committee had decided to postpone until after the end of the present financial year the consideration of any further fare reductions. A proposal for the award of prizes to members of the operative staff of the tramways department who submit practical suggestions for devices, etc., likely to minimise the number and duration of delays in the service, and for other ideas likely to be of advantage, has been arranged by the Highways Committee. The scheme provides that devices submitted by the staff shall be considered by an examining committee consisting of the general manager and the heads of the five branches of the tramways department. It is suggested that the amount to be distributed as awards should be £200 a year, the payment in each case being determined by the merit of the suggestion or device. The Highways Committee recommended that inspectors at the central repair depot should be divided into two classes, and that their basic rates of pay be fixed as follows—(1) £3 12s. 6d. a week, rising by annual increments of 5s. and 2s. 6d. a week

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respectively to £4 a week; (2) £2 10s. a week, rising by annual increments of 5s. a week to £3 10s. a week. This was approved. A new edition of the map and guide of the County Council Tramways has been issued. The map measures 16 in. by 12½ in., and shows clearly all the routes and services with terminal points. On the reverse side of the sheet are printed time tables for all routes, and particulars are given of the all-night services. The Council have issued a poster setting out the facts in regard to the tramway service. In the middle of the day the number of tramcars in service is at present 990. During the busy hours this number is increased to 1,450, and trailer cars are also run, making a total of 1,560 in service. The Highways Committee of Wimbledon Borough Council has been considering a communication from the London United Tramways, Limited, stating that negotiations were taking place between the London County Council and the company with respect to a proposal to run the London County Council tramcar service from London to Wimbledon. It was proposed that the lines be connected at Tooting, so that the London County Council cars might continue through Merton to the foot of Wimbledon Hill. Kingston-on-Thames Town Council have decided to object to any increase in the present speed limits on the London United Tramways which serve the district. A memorial to men of the Metropolitan Electric Tramways who fell in the war has been unveiled at Stonebridge Park Depot by the general manager, Mr. C. J. Spencer.

MANCHESTER.

Wage Dispute Settled—Driver's Record.

The Industrial Court have decided in favour of the Corporation in the dispute between them and the maintenance workers in the tramways and gas departments. The Corporation reduced the wages of these employees early in September. On October 19 the men stopped work on the advice of their unions, but resumed at the reduced rates on November 3, after agreeing with the Corporation that the matter should be referred to arbitration. At the hearing which took place at 5 Old Palace Yard, London, S.W., on December 13, in a division of the Industrial Court presided over by Sir William Mackenzie, the Corporation was represented by Mr. P. M. Heath (deputy town clerk), Alderman J. Bowes (chairman of the Tramways Committee), Dr. A. W. Chapman (vice-chairman), Alderman W. Kay, Councillor Cundiff, and Mr. J. Wood (assistant manager of the tramways department). The Court found that the Corporation was justified in making the reduction of 2d. an hour in the case of skilled workers and 1½d. an hour in the case of semi-skilled and unskilled men. The men affected in the tramways department number 250 skilled workers and 260 semi-skilled and unskilled men. Francis Redfern, aged 80, a Corporation tramcar driver, has retired after 41 years' service. He spent 22 years on the horse-drawn cars of the old Manchester Carriage Company, and 19 years on the Corporation's electric cars. Redfern has never been reported late for duty. The Tramways Committee has raised his pension from 12s. 3d. a week to 19s. 9d.

MIDDLESBROUGH.

Sunday Morning Car Service.

The Corporation proposes to discontinue the Sunday morning service, and cars will not start until 2 p.m. It was proposed that the service should be suspended from 6.30 to 8 p.m.

NEWCASTLE-ON-TYNE.

Protest Against Working Hours.

At a mass meeting of the Corporation tramways employees a resolution was passed protesting against the decision of the Council to rescind a former resolution granting a 44-hour week. It will be remembered that owing to the existing conditions the Council have found it necessary to revert to a 48-hour week.

NOTTS AND DERBY.

New Tramway Extension.

The proposal of the Notts and Derby Tramways Company for a new track from Heanor to Ilkeston has received the general approval of Heanor Urban Council.

PLYMOUTH.

Track Renewal.

The Minister of Transport has sanctioned, under certain specified conditions, a loan of £36,096 for the renewal of parts on the tramway track at Plymouth. One of the special conditions is that the rate of wages for unskilled labour must for a probationary period of six months be appreciably lower than the full district rate prevailing in the area. The cost of the above scheme does not include the provision of a new track in Alma Road, and application will be made to the Ministry of Transport for consent to give notice of intention to apply for an order authorising this work, the doubling of the track in Coburg Street, and an addition to the line at the eastern corner of Devonport Park, and other improvements upon which the Corporation have decided.

SALFORD.

No More Trolley-boys.

The Tramways Committee have ceased to engage trolley-boys. Those now employed will remain, but as they are gradually promoted their places will not be filled.

SCARBOROUGH.

Tramway System Changes Hands.

The service owned by the Scarborough Tramways Company, which was to have ceased permanently on December 31 last, has continued running, an offer to purchase the undertaking having been accepted by the management. This offer, which was subject to confirmation by the shareholders, came from a combination of London and Yorkshire engineers, with whom is associated Mr. H. Seaton, of the Yellow Motor 'Bus and Coach Service. Mr. Seaton will act as managing director. It is understood that the intention of the new company is to exercise their right, under the statutory power possessed by the present company, to run an omnibus service in conjunction with the tramways to every part of the town. At the beginning of the New Year the Scarborough and District Motor Services (proprietors, Robinson's Motors, Limited) commenced running vehicles on the tramway and other routes, and also doubled their service to the South Cliff. Messrs. Seaton and Company are also running a service of omnibuses. The Scarborough tramways were opened in 1904. The single track length is 7¾ miles, and the route length four miles. In summer the maximum number of cars (22) has been in use, but only six vehicles were found necessary in the winter. Mr. H. V. Moinet (general manager and electrical engineer) has attributed the failure of the company to make a profit to the inadequate length of the system, and its consequent inability to tap a sufficiently large area. The decision to cease operation followed a conference held on December 14 at the Ministry of Transport, at which representatives of the Corporation and the company were present. The tramways company, it is understood, had desired to cease running during the winter (as such a service was found unprofitable), and only to operate the cars in the summer months. The Corporation declined to consent to this.

SOUTHPORT.

Suggested Omnibus System.

The Tramways Committee, on the instructions of the Council, are considering the advisability of using motor omnibuses as an adjunct to, or in whole, or in part, in substitution of the existing tramways.

TAUNTON.

Absence of Tramcars Regretted.

At a meeting of the Town Council several members raised questions with reference to the possibility of a restoration of the tramway service, declaring that the present omnibus service was inadequate and unsatisfactory. Purchase of the undertaking by the Council was suggested, but did not receive much support. The Mayor stated that no steps would be taken immediately for the removal of the lines. Before the tramcars could be run again another Provisional Order would have to be obtained, and that would take at least twelve months. It will be recalled that the service of the Taunton Electric Traction Company ceased on May 28 last owing to differences with the Town Council over the charge for power.

WALLASEY.

Penny Fares Recommended.

The Tramways Committee have recommended the Town Council to restore penny fares on the tramways in the hope of increasing short-journey traffic. Each of the routes would be split up into penny stages, but the present 1½d. fares would be retained. Other proposals are as follows—A discount of twopence in the shilling on prepaid books of tickets instead of the present system of books of 13 tickets at the price of 12. Workmen's tickets to be available up to 7.30 a.m. instead of 7 a.m. The age for children's tickets to be 14 instead of 12. The recommendations are made in view of the seriously decreased traffic since the stages were shortened and the fares increased, and in order to popularise the tramways.

WIGAN.

Tramcar Mails—The Aspull Route.

The Tramways Committee will receive for the carriage of mails and postmen the sum of £500 per annum. Last year the Post Office paid only £200. The Watch Committee pay £200 per annum for the conveyance of the police. The Tramways Committee recommended the substitution of a motor omnibus service in place of the tramway cars from Springs Bridge to the Aspull terminus.

YORK.

Tramway Passenger Platforms.

Two raised temporary platforms have been placed outside the railway station close to the car lines, for the convenience of persons waiting for the cars. The platforms, which are marked at night by a red lamp at either end, offer a refuge from other traffic.

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PERSONAL.

Mr. Walter Rutherford has joined the board of G. D. Peters and Company, Limited.

Mr. J. G. Smeaton, deputy general manager of the Shanghai tramways, has resigned owing to ill-health after 14 years' service in Shanghai.

Mr. G. H. Wheeler, secretary of the Standing Committee of Railway Managers, has been appointed traffic manager of the Somerset and Dorset Railway.

Mr. D. H. Davies, of Heywood, has now accepted the position of general assistant in Chesterfield Corporation's electricity, tramway, and motor omnibus departments.

Mr. C. B. Collett, deputy chief mechanical engineer of the Great Western Railway, succeeded Mr. G. J. Churchward, who retired at the end of 1921, as chief mechanical engineer.

Mr. James Lord has resigned his position as borough engineer of Halifax, which he has held for 21 years. He has opened offices as consultant and constructional engineer at 17 Crossley Street, Halifax.

At the termination of the post-war work of the Ministry of Transport, the following honours were conferred—On **Sir Robert Francis Dunnell** (secretary of the North Eastern Railway Company) a baronetcy; on **Mr. Henry Allen Steward** (Principal Light Railway Commissioner) a knighthood.

Alderman W. G. Wylie has resigned the chairmanship of South Shields Tramways Committee, in order to make way for some younger man, after having held the position since the inception of the municipal undertaking. **Councillor J. G. Winskell,** the vice-chairman, has succeeded him.

Mr. W. A. Toppin, on relinquishing the position of assistant manager of the electricity, tramway, and omnibus departments of Chesterfield, was presented by the employees with a roll top desk. Mr. Toppin's address is now Toppin and Knowles, Limited, 202 Manningham Lane, Bradford.

Mr. George Hughes, chief mechanical engineer of the Lancashire and Yorkshire Railway Company, on January 1 became chief mechanical and electrical engineer of the combined London and North Western and Lancashire and Yorkshire Railway Company. **Mr. Arthur Watson,** who is the general manager, has now seven assistants. The superintendent of motive power for the existing Lancashire and Yorkshire Railway is now **Mr. F. W. Attock.** The duties of **Mr. E. F. C. Trench,** the former chief engineer of the London and North Western Railway, are now extended to cover the combined undertakings. **Mr. R. C. Irwin,** secretary of the Lancashire and Yorkshire Railway Company, succeeded Mr. James Bishop, who retired at the end of 1921, as secretary of the London and North Western Railway Company.

The late **Mr. John H. Balfour Browne, K.C.,** a leading counsel at the Parliamentary bar for various Corporations, left gross estate of the value of £655,000, and net personalty of £652,636.

We record with regret the death of **Mr. Montague Brown Mountain,** who was formerly connected with Mountain and Gibson, Limited, and latterly with the Gibson Roller Shutter Company. Mr. Mountain was in his fifty-third year.

Mr. Ernest Holt, who for the past nine years had been general manager of Ashton-under-Lyne Corporation Tramways, died recently at the age of 38. He went to Ashton as chief tramways clerk from Halifax in 1905, and succeeded Mr. Dugdale as manager in 1912. Under Mr. Holt's management the borough tramways have been completely reorganised.

Mr. Jacob Atherton, of Hurst House, Huyton, Lancs., one of the founders of the British Insulated and Helsby Cable Company, died at Torquay in his 69th year. Mr. Atherton, who was a native of Liverpool, was associated with his elder brother, Mr. J. B. Atherton, in many important commercial development schemes. When his brother returned from the United States in 1890 with the patent rights in paper insulated cables, Mr. Jacob Atherton joined him in the formation of the British Insulated Cable Company, and in the erection in 1890 of the extensive works at Prescot, which now bear the name of the British Insulated and Helsby Cables, Limited, the business of the Helsby Cable Company having been taken over more recently. The two brothers also established a number of electric lighting companies, of which Mr. Jacob Atherton was a director. Later they turned their attention to tramways, and promoted the construction of the South Lancashire system, which ultimately linked up Liverpool by tramway with Manchester. They also obtained a Light Railway Order for a tramway between Aigburth and Garston, which paved the way for the extension of the Liverpool municipal tramway service. Mr. Jacob Atherton was associated with tramway construction schemes in Australia.

BUSINESS NOTICES.

THE BRITISH EMPIRE TRUST COMPANY notifies that from January 1 their address has been Stafford House, 14-20 King William Street, E.C.4.

HENLEY TYRES.—The Bristol branch of the Henley Tyre and Rubber Company, manufacturers of Henley's "Zig-Zag" tyres and "Why Not" golf balls, is now at 146 Redcliffe Street.

Mr. PERCY FROST SMITH has requested us to announce that he has relinquished his residence in Maidstone, and is now residing in London. He has opened offices at 64 Victoria Street, Westminster.

BALDWINS PURCHASE THE EAGLE TINPLATE WORKS.—It is officially announced that the purchase of the Eagle Tinplate Works, Neath, by Baldwins has been completed. The works are reputed to be the best in the country.

Mr. D. LANDALE FREW, of 45 Hope Street, Glasgow, has been appointed by Hollings and Guest, Limited, as their sole agent for Scotland. Mr. Frew will be glad to hear from anyone interested in hydraulic machinery.

HYDRO-ELECTRIC PLANT FOR NEW ZEALAND.—A Reuter's message reports that the New Zealand Government have accepted tenders from British firms for £100,000 worth of plant for a hydro-electric power-station to supply Wellington and district. Mr. Massey, the Prime Minister, states that further tenders are under consideration. American and Swedish firms competed.

RANSOMES, SIMS AND JEFFERIES, LIMITED, of Orwell Works, Ipswich, have been appointed sole manufacturers and licensees in the United Kingdom, the Colonies, and Dependencies, South America, the Dutch Indies, and China, for the Kestner water-tube boiler. This type of boiler has been a great success in France, where it is manufactured by Schneider and Company, and is in use in many large municipal power stations.

A.E.C. COMMERCIAL MOTOR VEHICLES.—The Associated Equipment Company are prepared to appoint service agents in the large towns in Lancashire, excepting Liverpool and a 20-mile radius. Applicants must occupy premises in every way suitable for giving the best possible service to owners of A.E.C. vehicles. The agencies are offered only to applicants who are members of the Motor Trade Association. Particulars of plant, premises, etc., should be forwarded to the Associated Equipment Company, Limited, Walthamstow, London, E.17.

BETTINGTON WATER TUBE BOILERS.—The Fraser and Chalmers Engineering Works, of Erith (the proprietors of which are the General Electric Company, of Magnet House, Kingsway, W.C.), have placed on the market a new and improved design of Bettington pulverised fuel fired boiler, which is also suitable for colloidal fuel, oil, or gas firing. In its original form this boiler was first developed in 1905, and although notable success attended its adoption, certain inherent faults called for a remedy. The result is the evolution of the present central combustion chamber boiler, which has entirely eliminated the difficulties mentioned. It may be noted that the Bettington boiler is claimed to be the only type especially designed to burn pulverised fuel efficiently, and its advantages would be evident in power-stations, iron and steel works, etc.

TRAMWAY SUPPLIES, LIMITED., of Grove Mills, Meanwood, Leeds, have asked us to state that in order to deal more efficiently with their rapidly growing business in the South for both home and export requirements, they have opened an office at 93 Cannon Street, London, E.C.4, and have appointed Mr. Reginald Cox, late of the English Electric and Siemens Supplies, Limited, as manager. Mr. Cox has had many years' experience in tramway equipment requirements, and is fully qualified to deal with technical points or suggestions, as well as with the business details of prices, etc. In addition to their well-known point controllers, overhead and car equipment lines, Mr. Cox will also handle the range of high-class oil switches manufactured by the Tramway Supplies Company, comprising low, high, and extra high tension gear for all purposes, together with suitable high and low tension cable boxes and sub-station switch gear, fuse panels, etc.

THE LINCOLN WELDING PROCESS.—The Scholey Construction Company, Limited, of 56 Victoria Street, S.W., have taken over the agency for the Lincoln or R.W.B. dynamo plant from the Electrical Apparatus Export Corporation, and have adopted this type of welding plant for contract work in building up dished joints, and especially for the purpose of welding fishplates to the rails, as they believe it to be the best type of joint welding. The Scholey Construction Company will supply the welding plant, or undertake track or depot welding by contract. They will also be pleased to supply samples or tests or to give a demonstration of the class of work which can be done by the machine. The Lincoln welding apparatus is now in use on a number of important tramway systems in this country, including Belfast, Birmingham, Glasgow, Dundee, etc., and very satisfactory reports have been made with reference to the efficiency and convenience of the system.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Safety device for traffic control for motor vehicles (32,624)—W. Bottomley and J. C. Wignall.
Electric feeder connectors for contact rails on electric railways (33,098)—Callender's Cable and Construction Company, Limited, P. V. Hunter, and J. Mather.
Life-guard for motor vehicles (33,086)—W. C. Carter.
Variable speed gearing for motor vehicles (32,711)—E. R. Chandler.
Trucks for tramcars (33,027)—W. Forber.
Motor vehicles (32,573)—R. T. Gascodine and G. Spencer, Moulton and Company, Limited.
Mechanically-propelled vehicles (33,226)—R. F. Hall.
Brake mechanism of power-propelled vehicles (32,618)—F. W. Lanchester.
Transmission system for motor vehicles (32,763)—H. Mobbs.
Non-skid devices for motor vehicles (33,274)—W. J. Reynolds.
Steering and driving gear of motor vehicles (32,741)—H. G. Smith.
Tramway rail joints (33,047)—E. C. Strong.
Mechanically-propelled vehicles (32,871)—F. Theakston and F. Theakston, Limited.
Transport and trailer vehicles (33,923)—L. Dewing.
Omnibus seat (33,484)—G. H. W. Collis.
Lifting jacks (34,019)—C. J. Paffard.
Direction indicator for road vehicles (33,304)—R. Robinson.
Day and night direction indicator for road vehicles (33,589)—R. Robinson.
Brakes for motor vehicles (33,518)—A. E. Rooke.
Front wheel guards for motor vehicles (33,617)—C. H. Salmon.
Motor vehicles (33,604)—H. Shore.
Life-guard for motor vehicles (33,601)—C. Whittle.
Motor omnibuses, lorries, etc. (34,076)—G. A. Bishop and R. A. Chadwick.
Electric current collectors (34,166)—British Thomson-Houston Company, Limited, F. H. Clough, and H. W. H. Warren.
Lifting jacks (34,682)—H. Butcher.
Sand gear operator for electric vehicles and engines (34,583)—H. Clark.
Electric rail bonds (34,345)—P. Croom-Johnson.
Indicator for road vehicles (34,571)—W. P. Quane.
Driving gear for motor vehicles (34,148)—J. S. Withers (*Perfecto Gear Differential Company*).
Seats for tramcars, etc. (34,711)—M. Woods.
Electric trolley poles (34,868)—G. W. Ferguson.
Feed mechanism for strip-charts, etc., for tramcars (35,071)—E. H. H. Gordon and E. W. Lewis.
Sheet metal sleepers for tramways (34,794)—A. H. Hill, Hill and Roberts, and E. Roberts.
Braking systems of motor vehicles (34,840)—E. T. Jackson.
Control switches for electrically-propelled vehicles (34,959)—P. V Powell.
Lifting jacks (35,114)—N. F. Scarborough and L. F. Whitehouse.
Renewable tramway metals (35,030)—A. J. Tuck.

SPECIFICATIONS PUBLISHED

1920.

Life-guards for motor road vehicles (23,033—*171,150*)—W. J. Turner, J. W. Collen, and A. J. Rolfe.
Lifting jacks (25,540—*171,234*)—A. D. Powell.
Emergency brakes for road vehicles (33,707—*171,310*)—J. B. Gayler and A. W. Gilbert.
Brake lever connections for motor road vehicles (24,618—*171,505*)—O. D. Cars, Limited, and J. A. McKee.
Driving gear wheels of motor-driven tramcars, etc. (28,422—*171,583*)—J. Farley and T. R. Irving.
Car brake controlling means (29,413—*171,594*)—C. E. Rochambeau.
Operating mechanism for vehicle route indicators (32,942—*171,621*)—W. L. Lorkin, E. E. Daglish, and H. B. Swift.
Extra air device for internal combustion engined motor vehicles (26,832—*172,160*)—J. V. Wilmoth.

1921.

Braking systems for electrically-driven vehicles (1,422—*157,721*)—British Thomson-Houston Company, Limited.
Welded joints for tramways (3,446—*172,241*)—G. Wallace and H. Bolton.
Balance for sliding window panes of tramcars, etc. (11,956—*162,614*)—R. Mariani.

The Metropolitan Railway, after numerous experiments and exhaustive tests, have adopted as a standard for their country extension lines a type of locomotive which will enable them to accelerate the service. The new time table, which came into force on January 1, shows a substantial reduction on journey times of no less than 75 per cent. of the trains.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1920-21. WEEKS ENDED Dec. 11	Dec. 18	Dec. 25	Jan. 1		1921. WEEKS ENDED Dec. 10	Dec. 17	Dec. 24	Dec. 31		AGGREGATE. Wks.	1921.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	
Aberdeen Corporation	3,656	3,435	3,414	3,693	...	3.750	3,308	3,330	3.429	...	30½	110.560	− 9,459
Aberdeen Motor Buses	...	...	...	...	...	121	120	123	123	...	30½	8.050	+ 7.295
Ayr Corporation	523	521	546	572	...	496	485	523	513	...	33	25.777	− 1,441
Barrow Corporation	835	864	839	933	...	728	729	834	731	...	39	33.754	− 1,754
Belfast City Tramways	11,412	11.355	12.794	9.242	...	12.521	12.831	13.417	12.083	...	39	493.954	+ 45.737
Birkenhead Corporation	2.584	2.705	2 522	2.786	...	2.630	2.696	2.918	2,679	...	38½	103.264	− 11.970
Birkenhead Motor 'Buses	281	324	327	399	...	523	523	609	626	...	38½	27.284	+ 10.766
Birmingham Corporation	33,576	32.853	30.473	31.704	...	29.791	30.554	32 030	25.543	...	39	1.150.820	− 86.089
Birmingham Motor 'Buses	1.881	1.790	1.667	1.750	...	1.783	1.791	1.898	1.465	...	39	79.156	− 226
Blackburn Corporation	2.429	2.161	2.433	2.710	...	2.275	2.271	2.469	2.708	...	39½	95.610	− 8.017
Bradford Corporation	13.872	13.947	12.073	15.443	...	13.535	14.459	14.115	12.862	...	39	539.384	+ 18.697
Burnley Corporation	3.327	3.169	2.788	3.837	...	3.351	3.391	3.594	3.627	...	—	—	—
Burton-on-Trent Corporation ...	590	626	626	724	...	595	603	686	632	...	39	24.800	+ 910
Bury Corporation	2.141	2.153	1.986	2.639	...	2.326	2.302	2.408	2.524	...	39½	97.355	− 3.278
Chatham and District	1.549	1.455	1.750	1.857	...	1.451	1.538	1.689	1.958	...	52	86.658	− 3,422
Chesterfield Corporation	616	579	614	622	...	541	564	581	607	...	39	22.980	+ 36
Chesterfield Motor Buses	850	737	799	869	...	721	758	772	860	...	39	30.332	− 513
Derby Corporation	2.177	2.153	2.175	2.612	...	2.020	2.064	2.443	2.131	...	39	85.215	− 4.897
Dundee City	3.086	3.031	3.026	3.229	...	2.988	3.040	3.129	3.228	...	32½	105.911	+ 7.382
East Ham Corporation	2.204	2,121	2.599	2.083	...	2.074	2.198	2.384	1.951	...	39½	83.427	+ 2.963
Edinburgh Corporation	...	...	...	...	...	11.424	11.724	12 300	12.069	...	33	428.098	+ 12.525
Edinburgh Motor 'Buses	...	...	...	...	...	3.193	3.247	3.404	3.333	...	33	120.116	—
Glasgow Corporation	45.044	44.924	46.507	47.031	...	45.644	46 158	47.089	45.347	...	30½	1.399.986	+ 27,329
Glossop (Urban Elec. Supply Co.)...	243	233	201	286	...	234	253	281	278	...	52	12.635	+ 64
Halifax Corporation	4,176	3.971	4.198	4.276	...	4.017	4.187	3.940	4.570	...	37½	170.522	+ 5.176
Halifax Motor 'Buses	112	98	108	115	...	57	62	62	77	...	37½	3.090	− 1,215
Halifax Railless Cars	...	...	...	...	...	49	48	52	63	...	23	1.324	—
Huddersfield Corporation	5.051	4.872	4.400	6.065	...	4.836	4.828	5.253	5.100	...	40	209.956	+ 11.434
Ilford U.D. Council	1.321	1,286	1.293	1.412	...	1.439	1.503	1.702	1.363	...	39½	59.573	+ 8.091
Ipswich Corporation	753	803	826	968	...	759	805	949	768	...	39	34.539	− 4.325
Isle of Thanet...	417	398	482	654	...	478	536	583	657	...	12½	8.625	+ 1,228
Kilmarnock Corporation	350	332	374	421	...	350	347	369	381	...	32½	12.035	− 71
Leicester Corporation	6.502	6.461	6.207	7.095	...	7.407	7.391	8.029	6.754	...	52	345.971	+ 2.384
Liverpool Corporation	25.436	25.409	26.030	26.454	...	30.034	30.747	32.977	28.763	...	52	1.522.028	+ 101.952
London County Council	102.133	96.756	105.339	94.529	...	89.800	92.816	97.598	85.959	...	39	3.873.835	+ 305.511
Maidstone Corporation	385	360	447	449	...	387	409	467	446	...	38	18.902	− 308
Manchester Corporation	36.701	36.735	32.844	37,598	...	37.733	38.827	39.134	34.222	...	39	1.532.298	+ 199.007
Newcastle-on-Tyne Corporation ...	11.350	11.132	11.107	...	...	10.988	11.174	11.834	...	...	38	436.122	+ 14.691
Nottingham Corporation	7 258	7.105	7.799	6.924	...	7.173	7.445	7.708	7.433	...	39	263,860	− 39.313
Oldham Corporation	4.093	4.241	3.992	4.733	...	4,706	4.627	4,480	4.845	...	41	194.775	+ 4.542
Preston Corporation	1.853	1.739	1.881	1.957	...	1.798	1.891	1.933	2.134	...	38½	74.892	+ 4.483
Reading Corporation	1.503	1.481	1.808	1.618	...	1.478	1.573	1.747	1.778	...	39	62.566	− 2.764
Reading Motor 'Buses	219	221	278	304	...	280	301	336	373	...	39	13.535	+ 3.215
Rotherham Corporation	2.635	2.480	2.666	2.605	...	2.158	2.301	2.363	2.402	...	38	86.198	− 14.987
St. Helens Corporation	2.044	1.838	1.989	2.075	...	1.586	1.709	1.691	1,816	...	39	68.316	− 12.947
Sheffield Corporation...	20.350	20.292	18.838	21.276	...	19.126	18.979	18.919	19.425	...	39½	772.264	− 50.608
Southampton Corporation	3.067	2.854	3.151	2.955	...	2.805	2.896	3.138	2.957	...	39	116.083	− 7.266
Southampton Motor 'Buses	322	285	328	330	...	97	98	107	98	...	39	6.322	− 3.248
Southend Corporation	1.519	1.342	1.521	1.610	...	1.772	1.927	2.038	2.014	...	39	101.497	+ 6.238
South Shields Corporation	1.842	1.797	1.660	1,985	...	1.676	1.691	1.896	1.659	...	40.	67.325	− 9.015
Sunderland Corporation	2.886	2.905	2.660	3.068	...	2.532	2.461	2.584	2.681	...	39	104.024	− 17,562
Swindon Corporation	352	328	389	415	...	331	361	388	416	...	38½	15.646	+ 445
Tyneside Tramways and Tramroads	1.122	1.086	1.200	1,105	...	892	930	908	980	...	26	28.228	− 5.073
Wallasey Corporation	2.435	2,517	2.526	2.862	...	2.573	2.653	2.783	2,642	...	39½	111.518	+ 8.724
Wallasey Motor 'Buses	97	112	128	141	...	174	211	208	231	...	39½	9.530	+ 2.648
Walsall Corporation	1.886	1.878	1.857	2.344	...	1.576	1.642	1.882	1.656	...	40	65 008	− 5.453
Walsall Motor 'Buses	1.247	1.231	1.269	1.728	...	886	919	1.039	1 035	...	40	37.110	− 8.041
Walthamstow U.D. Council	1.823	1.751	1.958	2.194	...	1.778	1.867	2.021	1.762	...	39½	82.309	+ 1,235
Warrington Corporation	1.008	967	1.054	952	...	991	1.039	1.104	1.143	...	39	38.814	− 46
West Ham Corporation	6.315	5.967	7.121	6.142	...	5.881	6.269	6.844	5.802	...	39	232,414	+ 7.767
Wolverhampton Corporation ...	2.149	2.399	2.635	2.438	...	2,286	2,440	2.815	2.287	...	40	94.188	− 3.373
Wolverhampton Motor 'Buses ...	444	492	513	579	...	646	692	840	655	...	40	26.285	+ 8.791

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1920-21. WEEKS ENDED Dec. 11	Dec. 18	Dec. 25	Jan. 1		1921. WEEKS ENDED Dec. 10	Dec. 17	Dec. 24	Dec. 31		AGGREGATE. Wks.	1921.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	
Underground Rlys. & L.G.O. Co. ...	...	...	...	...	...	223.015	225.492	232,609	192,964	...	52	12,233,340	—
London and Suburban Traction ...	...	...	...	...	...	48.898	49,715	51,072	45,548	...	52	2.826.535	—

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.	1920-21. WEEKS ENDED Dec. 11	Dec. 18	Dec. 25	Jan. 1		1921. WEEKS ENDED Dec. 10	Dec. 17	Dec. 24	Dec. 31		AGGREGATE. Wks.	1921.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	84.948	83.801	82.930	96.157	...	85.923	82.715	85.516	97.287	...	52	4.203.369	+ 188.604
Calcutta ... ... Rs.	93,980	96,825	99.091	90,561	...	98,099	94,279	84,008	83,588	...	52	4,021,233	− 818,256
Madras... ... ... Rs.	...	...	...	...	...	...	...	...	...	...	—	—	—
Pernambuco	5.406	4,955	5.200	4,875	...	3.780	3.409	4,118	4.022	...	52	195,174	—

Companies issuing Monthly Statements only.

	1920. July	Aug.	Sept.	Oct.	Nov.	Dec.	1921. July	Aug.	Sept.	Oct.	Nov.	Dec.	Wks.	AGGREGATE. 1921.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	
Ballarat & Bendigo	3.690	3.588	4.192	4 442	4.810	...	3.842	3.809	4,231	4.682	5.137	...	32	35.525	+ 2.525
Brazilian Trac. Mlrs	11745000	11837000	12043000	13442000	12199000	...	15477000	15744000	14471000	15016000	14555000	...	48	155,462.00	+33156000
Brisbane	53.300	46.650	45.430	46.310	...	...	48 850	50.675	45.220	47.880	...	...	44	471.920	+ 12.590
British Columbia $	788.402	810.608	806.797	835.054	858.842	...	840.155	844.154	845.185	845 973	877.335	...	22	4.252.802	+ 153.099
Buenos Ayres L'c'z	51.508	53.952	53.603	57.619	56.746	62.857	51.944	55.873	55.873	58.492	58.056	63.381	26	343.619	+ 7.333
Burma	52.289	48.553	50.235	55,763	53.696	50.481	43.764	55.168	58.974	64.778	58.271	54.194	22	291,385	+ 32.657
Cape Town ...	23.711	...	23.699	...	25.628	...	25,571	25.164	25.755	26 839	27.004	...	—	—	—
Carthagena & H. ...	4.164	3.721	2.273	3.319	2,714	5,560	1.936	1.773	4.244	3.862	1,717	3,237	52	31.052	− 19.305
Cordoba	20.189	21.028	19.597	19.627	...	...	23.629	23.851	23.204	23,203	...	...	31	162.653	+ 22.646
East India ...	4.081	4 109	4.228	4,299	4,234	...	4.591	4.513	4.154	4.054	3,945	...	17	16.696	− 174
Kalgoorlie... ...	3.194	3.111	3.361	...	...	...	2.350	2,652	2.829	...	...	...	39	20.119	− 7.490
La Plata	5.353	5,715	5.656	6.310	5.573	...	5,425	...	...	6.587	6.453	...	48	58.098	− 3.652
Manila ... $	282.260	292.418	280.352	327.652	320.345	...	305.126	297.128	322.212	323,108	306.850	...	48	3.364.545	+ 260.755
Monte Video ...	39.647	42.771	41,816	45.246	43.846	...	42.411	44.672	44 927	47.927	47.426	...	4	47.426	+ 3.580
Para	24.243	24,571	23.174	26,772	24.273	24.253	24.655	22.940	22.225	25.548	23,147	22.660	5	22.660	− 1,593
Port Elizabeth ...	6.106	...	5.803	...	6.620	...	6.515	6.578	6.477	6.788	6.828	...	—	—	—
Rangoon ... Rs.	118.667	117,836	114,857	111,830	104,468	120,000	133,536	133,000	132,225	151,000	137,750	145.500	52	1.628.551	+ 228.798
Toronto ... $	1189.315	...	...	...	...	...	1229.483	...	...	...	...	...	31	8.877.669	+ 642.606
Winnipeg ... $	391,709	368.616	426.647	444,899	477.957	...	390.109	393.823	417,174	441,315	477.880	...	22	4.910.971	+ 156,466

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60,500 MILES WITHOUT HEAVY REPAIRS

Letter Extract from :—

United Automobile Services, Ltd.,
Laundry Lane,
Lowestoft.

Dear Sirs, 16.11.1921.

"I am rather pleased at the record made by your Chassis No. 15363, which was placed in service by us on 1st July, 1920, and which is now about to come in for overhaul.

This chassis has now covered a total of **60,500** miles without coming in for heavy repairs."

Yours faithfully,
(Sgd.) E. B. HUTCHINSON,
General Manager.

See the
A.E.C. EXHIBITS
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THE SCOTTISH MOTOR SHOW
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STAND 146.

FOR PASSENGERS
28 to 57 Seating Capacity

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ALL CHASSIS PRICES GREATLY REDUCED

One of Edinburgh Corporation's fleet of 29 A.E.C. Single Deck Omnibuses.

We invite enquiries for new and reconstructed Chassis

Associated Equipment Co., Ltd.,

WALTHAMSTOW, LONDON, E.17.

'Phone - - Walthamstow 780 (9 lines)
Wire - - "Vangastow, Waltstreet, London."

505

BUILDERS OF LONDON'S BUSES

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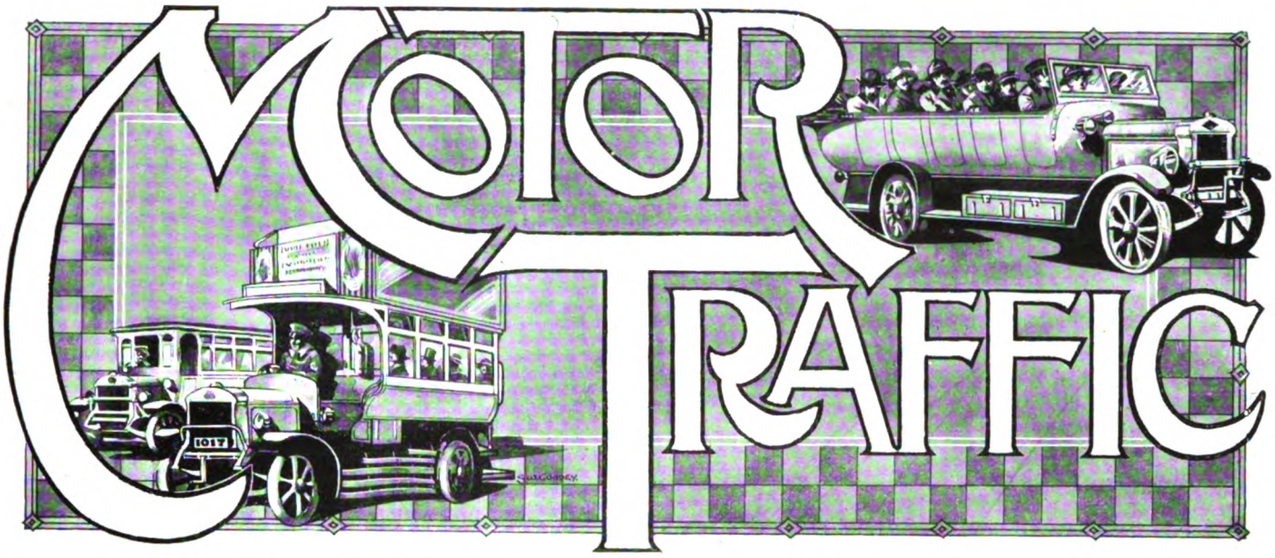

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

RETROSPECT AND PROSPECT.

In view of the general trade depression, the progress made during the past year in the adoption of motor transport must on the whole be regarded as encouraging. The year 1921 has been particularly noticeable for a great advance in respect of the motor coach, both as regards the types and numbers of vehicles employed and the variety of uses to which they are put. It took some time to secure anything like general realisation of the fact that the motor coach has far greater possibilities than its predecessor, the horsed char-a-bancs. Used at first merely for comparatively short pleasure trips, it was only when the railway services were dislocated, first by strikes and then by coal shortage, that the public, and even the motor coach proprietors themselves, began to realise the possibilities of running these vehicles regularly to schedule as means of passenger conveyance from place to place. Given the absence of unduly restrictive legislation, the motor coach is bound to become more and more prominent with every summer season. It is still questionable whether it will ever be seriously regarded as an all-the-year-round conveyance. Even for seasonal use a good deal still has to be done in the way of organised provision for the collection, carriage, and delivery of passengers' luggage. In a recent note reference was made to the possibility of successful local agitations in favour of the closing of certain roads against motor coach traffic. These agitations will not suppress the motor coach movement, but may alter its character, by compelling the use of smaller vehicles and consequently the charging of higher fares. During the past year a fair number of trading concerns have joined the ranks of users of motor vehicles for the carriage of goods. From the standpoint of the manufacturing industry, however, progress has not been satisfactory, and the industry cannot be expected to recover its full prosperity so long as it is subjected to the competition of immense numbers of second-hand vehicles thrown on to the market directly or indirectly by the Government. No good purpose can now be served by reiterating all the old arguments against the system of disposal that was in fact adopted; but the Government still has it in its power to ease the position to some extent by considering the motor manufacturing industry's interests in connection with the disposal of the vehicles still remaining in its possession but not likely to be required very much longer.

RAILWAYS AND ROADS.

It seems certain that the question of the extent of the powers of railway companies to run road motor services will be settled at a fairly early date. Important groups of railways are promoting private bills, seeking extended, though still more or less restricted, powers. Road carrying interests are naturally very apprehensive as to the future. It is almost impossible to conceive safeguards which, while giving the railways the powers sought, would effectively protect independent road carriers against fatal competition. It appears that the railways are willing to undertake not to manufacture motor vehicles for themselves in the near future. This would mean that, if they became large motor users, they must in the first instance purchase from existing motor manufacturers. Their orders would, of course, be just as welcome to the manufacturer as would the orders of road carrying concerns, with the exception that the railways, on account of their size, will no doubt be able to insist on the most favourable possible prices, cutting the manufacturer's profit to a minimum. It is, moreover, difficult to see how any provision could be made to prevent the railways from promoting more or less independent but still subsidiary manufacturing concerns. Equally, assuming that the railways are not granted the powers they seek, it is difficult to see how they can be prevented from attaining their ends by other means, creating road carrying concerns closely allied to them, but not subject to the statutory obligations imposed upon the railways themselves. Undoubtedly there will be considerable opposition to the railways' proposals; but when all things are considered one questions whether such opposition can be permanently successful, and whether it would not perhaps be better to let the railways have their own way and run their own services rather than to encourage the adoption of various roundabout methods to attain the same ends.

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MOTOR TRAFFIC

FUEL CONSUMPTION AND ROAD CONDITIONS.

Reference was made in last month's notes to the importance of keeping records of the performance of vehicles. Some users make the mistake of thinking that the only record necessary to keep is that of fuel consumption. This is a mistaken view, but nevertheless records which do no more than indicate regularly the fuel consumption of each vehicle are of very distinct value. The amount of petrol issued to each vehicle should be regularly chronicled, and periodically the fuel consumption should be worked out in miles per gallon. The resulting figures may be charted on squared paper, and the curves thus obtained will show very promptly if there is a serious falling off in the efficiency of one or more of the vehicles. The mere fact that petrol consumption per mile is found to increase is not in itself conclusive evidence that the vehicle needs attention. The increase may, for instance, be due to the condition of the roads or to the density of the traffic. Some increase of petrol consumption must be expected during the winter and during any time when traffic is particularly congested. These fluctuations will, however, affect all vehicles alike, and it is therefore particularly when the curve for one vehicle shows clear signs of differing from the curves of other vehicles that investigation is required. To a certain extent records of fuel consumption will serve also to indicate the efficiency of drivers. Some men will habitually obtain better results than others, but before jumping to conclusions it is necessary to be quite certain that the fault is not with the vehicle rather than with the driver. Vehicles that are apparently identical are not all capable of showing the same fuel economy.

THE SOURCE OF POWER.

It is rather a curious thing that, while the petrol vehicle is on the road in far greater numbers than steam or electric vehicles, it is on the whole easier to state a case on behalf of either of the two latter. Thus the electric vehicle has several marked advantages, including silence, smooth acceleration, and retardation, cleanliness, absence of smoke, ease of control, and so on The outstanding advantage of the steam vehicle is, of course, the comparatively low price of its fuel, but this is an item of first importance. On the other hand, the limitations of the electric vehicle are fairly obvious, and however satisfactory it may be from the standpoint of cheap maintenance and ease of handling, its limited radius of action must always prevent it from being a serious general competitor except in certain more or less limited spheres. The electric vehicle naturally appeals strongly to municipalities which own electric power-stations, and so are able to supply their own vehicles with fuel at low cost and at the same time to provide work for the power-station during the periods of light load. The electric also deserves far wider recognition than it has yet received in this country for such work as retail deliveries in towns where the mileage involved is not large and the number of deliveries to be made is considerable. On a round of this sort its average speed is probably no less than that of the petrol vehicle, while on an open road the petrol vehicle has a marked advantage. The main limitation of the steamer is that, for a variety of reasons, it can only be satisfactorily produced in a limited range of sizes. It has never proved a serious competitor of the petrol vehicle for loads much under three tons. Minor disadvantages are the bulk and weight of its fuel supply and of the water that must be carried and the fact that the water supply needs replenishing from time to time, and the continued efficiency of the vehicle therefore depends to some extent on the quality of the water available at a variety of points. The nature of the fuel and the need for carrying fairly large stocks of water is not the only disadvantage, inasmuch as these supplies occupy space which could otherwise be devoted to useful load. There is the additional disadvantage that, given a maximum legal weight of a laden vehicle, the heavier the supplies the smaller is the margin left for useful load.

Perhaps, however, the biggest advantage possessed by the petrol vehicle is the natural consequence of its suitability for all sorts of work. Because it can be used for carrying any load from the lightest to the heaviest, it is in such general use, irrespective of considerations of comparative economy, that there is hardly a village in the United Kingdom where one cannot pick up the necessary supplies or obtain some sort of mechanical assistance. The other extreme is represented by the electric. Here we have a machine which very seldom fails on the road, but if it does there are comparatively few people capable of tackling the job of putting it right. If a complete network of service stations for electrics could be established all over the country, so that assistance in respect of repairs would always be obtainable, and charging facilities would be everywhere available, then the electric would become a very serious competitor of the petrol machine for all loads and purposes. Before this can happen, however, the development must pass through intermediate stages during which the facilities in support are few and far between, and the cost of current for charging purposes is extremely variable. The trouble is that the complete network of service stations could not be remunerative unless very large numbers of vehicles made regular use of it, and, on the other hand, it is not likely that a very large number of vehicles of this type will be put on the roads until such stations are available. Each development waits on the other with the result that neither can mature.

A TRIBUTE TO BRITISH VEHICLES.

Less Costly to Run than Foreign Machines.

A firm using a large number of British made motor vans sought to effect an economy by purchasing foreign made chassis at about £200 less than the cost of the make that they had hitherto used with success. Allowing for depreciation, etc., this meant an estimated advantage for the foreign machine of about £35 per annum. It has been found—solely as a result of keeping separate and not *en bloc* motor accounts—that the average operating cost per mile of the British vehicles is no less than 5d. per mile lower than the average cost of the newer foreign vehicles, the average mileage of each motor being approximately 12,000 per annum. A saving of 5d. per mile represents an economy of £250 per annum. Deducting the anticipated saving of £35 per annum on each of the cheaper vehicles, there is seen to be a net advantage in favour of the type originally employed of no less than £215 a year. If these records had not been kept and analysed for a special purpose, the vehicle owner might have been a long time discovering what has now been made clear—i.e., that he will effect an economy by selling his foreign vehicles and substituting therefor motors of the type that were originally employed.—*Birmingham Daily Post.*

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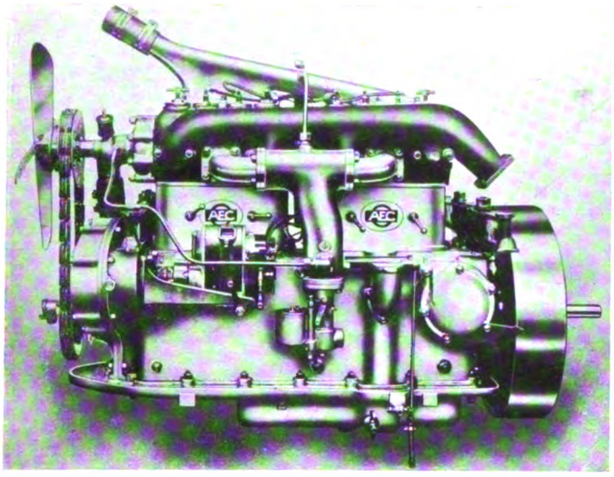
MOTOR TRAFFIC

A.E.C. 45-H.P. 5-TYPE ENGINE.

DETAILS OF A NOTABLE DESIGN BY THE WALTHAMSTOW WORKS.

Through the courtesy of the Associated Equipment Company, Limited, full information is now available of their new 45 H.P. 5-type internal combustion engine. A brief specification is as appended—

Bore, 120 mm.; stroke, 150 mm.; H.P., 45 at 1,000 revolutions per minute; R.A.C. rating, 34·6 H.P.; valves on one side; 3-point adjustable chain drive for camshaft and magneto; combined pump and fan driven by 1 in. V belt; pump and trough lubrication



A.E.C. New Engine for Lorries and Coaches.

with level adjustment; aluminium alloy pistons; enclosed fool-proof governor; Zenith carburetter; Peel Conner impulse starter magneto.

RESULTS OF EXACTING ROAD TESTS.

During the war period the Associated Equipment Company supplied over 13,000 4-ton lorries to the British and Allied Armies, these vehicles being fitted with a proprietary engine standardised by the Ministry of Munitions for several types of vehicles for army use. In accordance with the progressive policy of the A.E.C., it was decided, soon after the termination of the war, to embody in their programme an improved design of engine suitable for 4-ton commercial vehicles and luxurious coach chassis. The result of this policy is to be seen in the new engine which is the subject of this notice.

All the features embodied in the design have been thoroughly tested both in engines fitted in the London General Omnibus Company's omnibuses, and in experimental engines of the new type which have been running in vehicles used by the Associated Equipment Company in connection with their service and stores systems for nearly twelve months, and the engines are now being manufactured at the Walthamstow works in quantity. In ordinary daily work A.E.C. lorries fitted with this engine have been giving between 50 to 60 ton-miles per gallon of fuel, and averaging 700 miles per gallon of lubricating oil.

The four cylinders, cast in pairs from best quality grey cylinder iron, have a bore of 120 mm., and with a piston stroke of 150 mm. develop a minimum of 45 H.P. at 1,000 revolutions per minute before passing test. This is equivalent to a brake mean effective pressure of 85 lb. per square inch at 800 revolutions per minute; the brake mean effective pressure reaches 90 lbs. per square inch, an unusually high figure for a commercial vehicle engine.

COMMERCIAL ESSENTIALS STUDIED.

The poppet valves, of special alloy steel, are arranged on one side of the engine, and open into an "L"-shaped combustion chamber, the shape of which received considerable attention when the engine was designed, to ensure a high power output at normal working speeds. The sizes of the valves and induction pipes, together with the timing setting, are arranged to give maximum torque with economical fuel consumption over the working speed range. No attempt to obtain high power at very high speeds has been made, since this can only be effected at the expense of the more useful pulling power at lower speeds which, for commercial work, is most essential.

The aluminium crankcase, which is extended below the crankshaft centre in order to provide maximum stiffness, carries the 3-bearing crankshaft running in white metal lined bronze bearings, which are mounted in registered aluminium caps with steel stiffening plates. The main bearing bolts are screwed into the crankcase from below and continued through the case, being finally locked by nuts at the upper end. The crankshaft is manufactured from a nickel chrome steel stamping suitably heat treated, all bearing surfaces being ground to accurate dimensions. It is balanced dynamically on a Norton balancing machine.

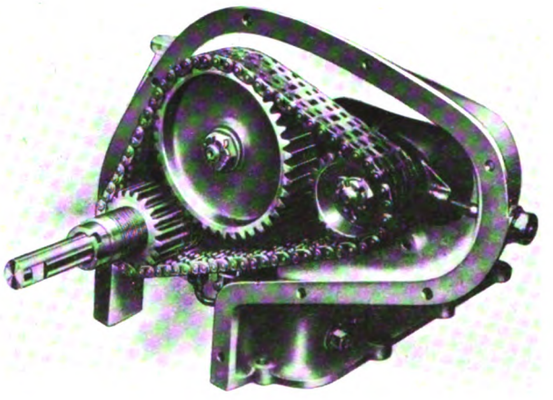
The connecting rods are made from "H" section steel stampings, and carry aluminium alloy pistons, the gudgeon pins being clamped in the rods and working direct in the pistons. This construction has been found to be highly satisfactory, the aluminium alloy forming a perfect bearing metal for the pins.

The bearings are lubricated by oil collected from the cylinder walls, and directed by suitable oil holes to the bearing surface, the latter, owing to the special pin fixing, being unusually large in area. Four cast-iron piston rings are fitted, three at the top and one at the lower end which acts as an oil scraper. Below the third ring from the top an oil relief groove is machined in the piston with suitable escape holes. The piston clearances have been very carefully fixed, and the pistons themselves are free from slap and have no tendency to seize. The arrangement of rings and grooves in the pistons allow for ample lubrication of the cylinder walls with a very low oil consumption.

CHAIN ADJUSTMENT WITHOUT MAGNETO DISTURBANCE.

The valves are actuated by cams, which are integral with the camshaft. The cam profiles are accurately ground to shape after hardening, very close limits of accuracy being worked to. The camshaft, which runs on a roller bearing in front, and plain bearings at the centre and rear, is fitted with a double ball thrust locating bearing, and is driven by a silent chain from the crankshaft. The drive is a triangular one, the chain also passing over the magneto driving pinion; the latter is built up with its bearings and magneto platform in one unit, and is arranged to slide to adjust chain tension.

This construction allows for chain slackness to be taken up quickly and without disturbing the alignment of the magneto, which is a Peel Conner fitted with an impulse starter, and driven through a rubber coupling with vernier adjustment for accurately setting the firing point. As it is possible after long use that the spring in the impulse starter may fracture, provision has been made for



The Wide Timing Chain with Adjustment.

a small set screw (which is permanently in readiness on the magneto) to be removed from its temporary position and screwed into a specially tapped hole in the coupling, which is thereby locked in the normal running position. It can remain thus until a convenient time for replacing the starter spring.

The water pump is bolted direct to the front cylinder and is driven by a 1 in. whittle belt from the crankshaft. The pump spindle is extended to drive the fan, which is an aluminium casting, the blades being formed to induce a horizontal draught from the

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MOTOR TRAFFIC

radiator without producing a centrifugal action on the air current. The pump has a connection on the suction side to the induction pipe water jacket, and draws hot water from the cylinder top cover through the jacket, which is extended sufficiently far along the induction pipe to ensure satisfactory vaporisation of the mixture supplied by a Zenith carburetter.

THE FOOL-PROOF GOVERNOR.

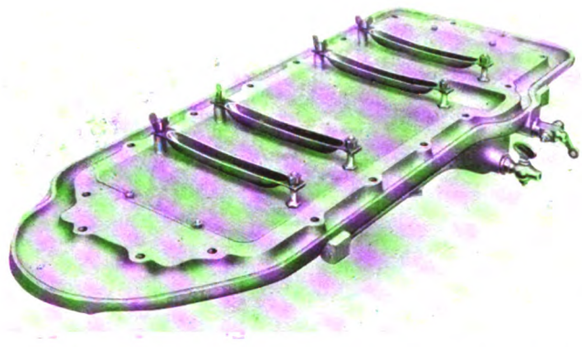
Above the carburetter is a butterfly valve in the induction pipe, operated by a centrifugal governor driven by skew gearing from the camshaft. The governor is of robust construction, the weights being very heavy and the spindle running on ball bearings. Friction of the operating mechanism has been eliminated as far as possible

Connecting Rod and Piston—Showing Solid Dipper and Shims.

and all connections are totally enclosed, the whole system being protected from interference by unauthorised persons, who cannot tamper with the adjustment without dismounting covers which can be sealed when necessary.

The governor operates with perfect smoothness without hunting or snatching, and when on the road its action is unnoticeable. The speed adjustment is set approximately 1,400 revolutions per minute, thus allowing a reasonable road speed on low gears. There is no advantage in governing to a road speed of 12 miles per hour on top gear to the detriment of speed on lower gears, and the setting arranged for prevents the engine being mishandled by careless or reckless drivers, but does not prevent reasonable average vehicle speed being maintained.

Lubrication is by the pump and trough system. A gear pump driven by skew gear from the camshaft depends into the oil sump, the pump and drive being wholly contained in the top half of the



Crankcase Oil Sump—Showing Large Area Filter and Adjustable Trough.

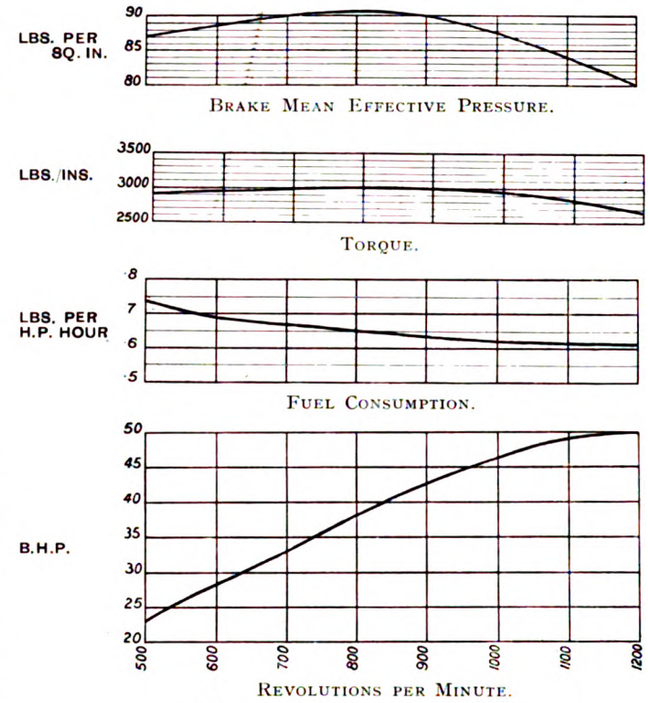
crankcase. Oil is forced to a gallery pipe which feeds the troughs under the big ends, and also the main bearings, by means of direct connecting pipes. The main bearings have also splash cups provided.

ENGINE SUITABLE FOR EXISTING CHASSIS.

Dippers, machined integral with the connecting rod cups are arranged to dip in the oil in the troughs and distribute lubrication to the big ends, cylinders, and other working parts of the engine. The troughs themselves are steel pressings, and are individually adjustable for level by wing nuts, accessible through the two circular engine doors on the offside of the crankcase.

The oil passes through two filters before entering the pump, one being a perforated zinc sheet covering the whole area of the lower half of the crankcase, and the other a detachable gauze filter directly connected to the pump inlet. The filter is removable through the side of the sump, and is retained in place by a screwed cap and spring, the latter holding the filter casing on its seating.

The engine is arranged to be suspended in the chassis by two overhead stamped steel cross members. The front member is



A.E.C. 5-Type Engine Records.

attached to the crankcase by an extension of the front main bearing bolts, and the rear member by two bolts passing through the main crankcase casing at its extreme width. The suspension thus provided is of the semi-three-point type that has proved to be highly satisfactory in A.E.C. vehicles for many years. It relieves the crankcase from strain due to frame flection, without being sufficiently flexible to loosen water connections.

Complete with cross members and flywheel (weighing 1 cwt. 3 qrs.), the engine weighs 8 cwt. 3 qrs., and sells at £275 retail. The engine can be fitted to existing A.E.C. 4-ton vehicles with very little alteration to the chassis, full particulars of which will be readily supplied by the makers.

RAILWAYS AND ROAD TRANSPORT.

POWERFUL GROUP'S APPLICATION FOR POWERS.

A Bill to be promoted next session by the North Western and Midland Group of Railways contains a clause to enable them "to provide, own, work, and use omnibuses and motor cars and other road vehicles to be worked by electrical, mechanical, animal, or other power for the conveyance of passengers, passengers' luggage, parcels, animals, and goods." Opposition will be offered by motor manufacturing and operating interests on the ground that the powers sought would enable the companies to manufacture their own vehicles and to so manage road transport with the aid of the railway profits that they will obtain a monopoly of road transport.

U.S.A. RAIL CAR AND OMNIBUS COSTS.

The White Motor Company, of Cleveland, U.S.A., predict that in the immediate future there will be a great development of business with street railway companies that are now operating at a loss. The White Company assert that the cost of electric rail car operation is about 3 dollars a mile, while it is less than a dollar with a petrol engine. Many inquiries, the company state, are being received from inter-urban tramway companies about types of engines and cost.

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MOTOR TRAFFIC

ELECTRIC VEHICLES FOR STREET WATERING.

The electric vehicles which are here illustrated were supplied to the Islington Borough Council by Electricars, Limited, of Seymour Place, London, W., and are arranged to serve the dual purpose of street watering and house refuse collection. A fleet of eight vehicles is now in service, and we understand that very satisfactory results have been obtained from their use, showing substantial saving in the cost of the work done. The chassis employed is the makers' latest design, known as the "E.A." type, and embraces all the improvements which experience in electric vehicle manufacture has evolved. An alteration of considerable importance has been made in the braking system, as both brakes in the new models are of the external expanding type acting on the rear wheel. As will be seen from the illustrations there are two driving motors and these, as well as the controller box, are mounted on the outside of the chassis frame, thus providing easy accessibility. Great importance attaches to this feature of the chassis design, for a considerable saving in labour costs as well as in the time a vehicle is out of service is effected whenever adjustments or replacements are found necessary. The Edison standard steel accumulator is the battery installed in these vehicles, each of which is covered by the makers' guarantee of 60,000 miles or for a period of eight years. Accessibility is again a feature in the positioning of the battery, for this is carried partly in a compartment arranged in the front of the chassis under a bonnet, free access being obtained by raising a section of this from either side, and partly under the driver's seat in a steel compartment to which access is also easy.

The cylindrical steel water tank has a carrying capacity of 750 gallons, and is provided with two baffle plates inside to prevent the water developing an excess of sway while travelling. In order that the driver may have a complete view of his work, the sprinkler gear is mounted in front of the vehicle. A spray of 21 ft. in width is obtainable, and, as the accompanying photograph illustrates, a good wide road can be well watered. This, however, can be regulated to suit the varying conditions of the service.

Edison Electrical Vehicle for Street Watering—Islington Borough Council.

Islington Borough's Fleet of Edison Electric Vehicles for Street Watering.

Perhaps one of the most notable features of the equipment is the fact that by means of a sub-frame the water tank is rendered interchangeable with an electrically operated tipping body. This is obviously a great advantage, as in the case of the vehicles under consideration they are used for house refuse collection in the winter months and road watering in the summer. The sub-frame is of a most substantial character, and is built up of rolled steel of channel section with suitable cross members, giving an overall width of 5 ft. 6in.

The following is a brief specification of the "E.A." chassis. The frame is of the built-up type, the side members having two high tensile steel flitch plates with well-seasoned American ash filler pieces. The cross members are of solid drawn steel tube anchored to the side members by means of machined steel brackets. The front fender is of heavy section English oak faced with steel plate, the whole frame being braced by tie-rods of high tensile steel with provision for adjustment.

The rear axles are of 3 per cent. nickel steel specially heat treated, the front axle stubs being of an alloy steel drop forgings, also heat treated. The springs are of exceptional length and resilience, and are of the semi-elliptic type. The forged ends are bushed and fitted with screw-down grease cups, the shackle pins being case-hardened and ground to fit. The steering gear is totally enclosed, and is of the worm and sector type, the worm being of hardened steel with phosphor bronze sector of heavy type. Transmission is by twin motors driving the rear wheels independently, the first stage by internal gear on motor shaft, and thence by floating cardan shaft to bevel pinion and crown wheel rear axle. The universal joints are all fitted with ball bearings. The motors are of specially designed four pole series traction type, normal rating 45 amperes, 60 volts. They are designed to stand an overload of 100 per cent. for a period of 30 minutes without dangerous rise in temperature. A patent new design of controller is fitted; this is of the flat plate type, totally enclosed. It is easy of access for inspection and is arranged for a quick break on each speed. A hand-operated safety switch is mounted on the dashboard, this being arranged with three positions—running, neutral, and charging.

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MOTOR TRAFFIC

MOTOR VEHICLES FOR MUNICIPALITIES.

WILLESDEN URBAN COUNCIL have plans for a central fire station.

LEYTON URBAN COUNCIL are purchasing two 2½-ton electric vehicles for refuse collection.

WALTHAMSTOW URBAN COUNCIL have prepared plans for the erection of a new fire station.

COOMBE AND MALDENS URBAN COUNCIL are inviting quotations for the supply of an electric vehicle.

LANCASTER WATCH COMMITTEE recommend the purchase of an Aldsmobile chassis at a cost of about £350.

CHELSEA BOROUGH COUNCIL have decided to experiment with motor vehicles suitable for municipal work.

GLASGOW WATCH COMMITTEE recommend the purchase of two Dennis six-cylinder turbine motor fire engines at £1,860 each.

PRESTON CLEANSING COMMITTEE have adjourned the consideration of further tenders for the supply of motor tipping wagons until March.

THE FIRE BRIGADE COMMITTEE of Heston and Isleworth Urban Council recommend the purchase of a combined motor fire engine and escape.

GLASGOW GARAGE COMMITTEE have asked the manager to obtain estimates of the cost of two 4-seat 12 H.P. open cars for the garage department of the Corporation.

GLASGOW CORPORATION LABOUR COMMITTEE, having further considered the desirability of undertaking their own cartage work, recommend that no action be taken.

SYDNEY (N.S.W.) MUNICIPAL COUNCIL have decided to purchase an American Studebaker pneumatic street flusher. The cost, delivered in Sydney, is estimated at £700.

TYNEMOUTH CORPORATION have instructed the cleansing superintendent to submit a report showing the comparative cost of removing refuse by horsed vehicles and by motor vehicles.

JOHANNESBURG MUNICIPAL COUNCIL, to enable comparison to be made between mule and motor transport, have decided to purchase a Clayton wagon for £1,450; a Sentinel wagon for £1,600; and a Yorkshire wagon for £1,575.

LONDON COUNTY COUNCIL have purchased a second-hand, rebuilt standard 12-16 H.P. Sunbeam car, with accessories, for £400. It is for the fire brigade service, and the Council mention that some of the service motor cars have been in use for over ten years.

WHEN A GIANT PNEUMATIC BURSTS.

EXPERIMENTS AT HIGH SPEEDS.

At the instance of *Motor Transport*, the Goodyear Tyre and Rubber Company conducted experiments with a 4-ton van running on giant pneumatic tyres for the purpose of observing the result of punctures. One of the front wheels was first run over two spikes with sharpened ends set obliquely in a thick iron plate fixed down to a board of ash. The spikes were on a slant. The speed of the lorry was 27 miles an hour, and the tyre burst instantly. Within eight feet past the spikes it was completely flat. The vehicle was kept under control so easily that the driver was able to steer round pot-holes in the road 20 yards from the bursting point, and he stopped without difficulty. The drop of the lorry on the burst tyre side was only 4¾ in. The tear in the cover was 4 in. long, and the slit in the tube 5 in. By means of a cord an assistant standing in the road withdrew the spiked board before the rear tyre passed. After a new front tyre had been fitted, several attempts were made to puncture a rear tyre, the driver having to miss the spikes with the front tyre and swerve across to hit them with the rear. Several attempts at 35 miles per hour proved futile, and on the speed being lowered to 15 miles the spikes caught the edge of the tyre. There were two 1 in. slits, the air taking 20 ft., or roughly one second, to escape. The vehicle was loaded with two tons of ballast. It was pulled up without mishap.

TRACTION COSTS AT YORK.—The appended quarterly statement has been issued, showing the receipts and expenses per car-mile of the municipal traction services—Omnibuses, receipts 15·85d., expenses, 17·97d.; tramways, receipts 21·57d., expenses 16·59d.; railless vehicles, receipts 17·17d., expenses 11·48d.

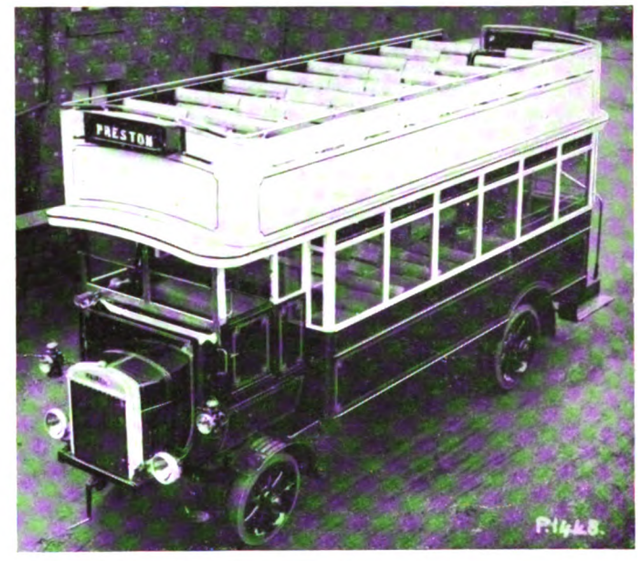
63-SEAT LEYLAND OMNIBUS.

A notable feature of the new Leyland omnibus with the largest passenger carrying capacity in the world is its lack of a cumbersome appearance. As the accompanying photographs indicate, the body is of pleasing design, while constructed on lines giving the greatest possible strength.

The body is mounted on one of the new O.P. type chassis—one of the Leyland Motor Company's overtype models—fitted with a 40-48 H.P. engine and their usual transmission, with the addition of an auxiliary spring device on the rear wheels. This spring is so designed that it will adjust itself to any load of body weight. When the omnibus is running light the small auxiliary spring, which can be seen in the photograph on the following page, comes into operation and avoids any great shock on the machine. When, however, the vehicle is fully loaded, this spring is locked tight and the load is taken by the usual semi-elliptic springs in the ordinary way.

This type of machine—known as the overtype—allows a very much larger body space to be taken without necessarily increasing the overall length. In the case of this particular machine the body space is 16 ft. 9 in., and its overall length 27 ft.

The seating accommodation is such that it will allow for 28 passengers inside, eight seats of which form a smoking compart-



ment. The top deck accommodates 34. The precise arrangements are indicated in the diagram. There is a very large platform at the rear, which allows plenty of room for passengers entering the interior or climbing the stairs, without any possibility of undue congestion.

The panelling of the body is entirely made of wood. One of the great advantages resulting therefrom is that there is no possibility of any drumming occurring, as is sometimes the case when metal panels are used. The interior is finished in a selection of mahogany and ash. The roof is of 3-ply maple-faced wood, which, combined with the rattan upholstery and the exterior, presents an extremely handsome appearance. The omnibus is fitted with the usual equipment, and has the standard 12-volt electric lighting set.

SMOKE FROM STEAM VEHICLES.—A deputation from the Horse and Motor Contractors' Association has waited upon the Parliamentary Committee of the Glasgow Corporation to express objection to the proposal to seek power to impose penalties in respect of the emission of smoke from mechanically-propelled vehicles. The deputation urged that because of the difficulty in getting a suitable fuel the proposals were too stringent, and suggested that the existing powers of the Corporation were sufficient to deal with the subject. The deputation also objected to a clause as to lights on vehicles on the ground that it was not necessary for slow-going vehicles to carry lights in streets which were lighted. The committee decided to make no alteration in the clauses.

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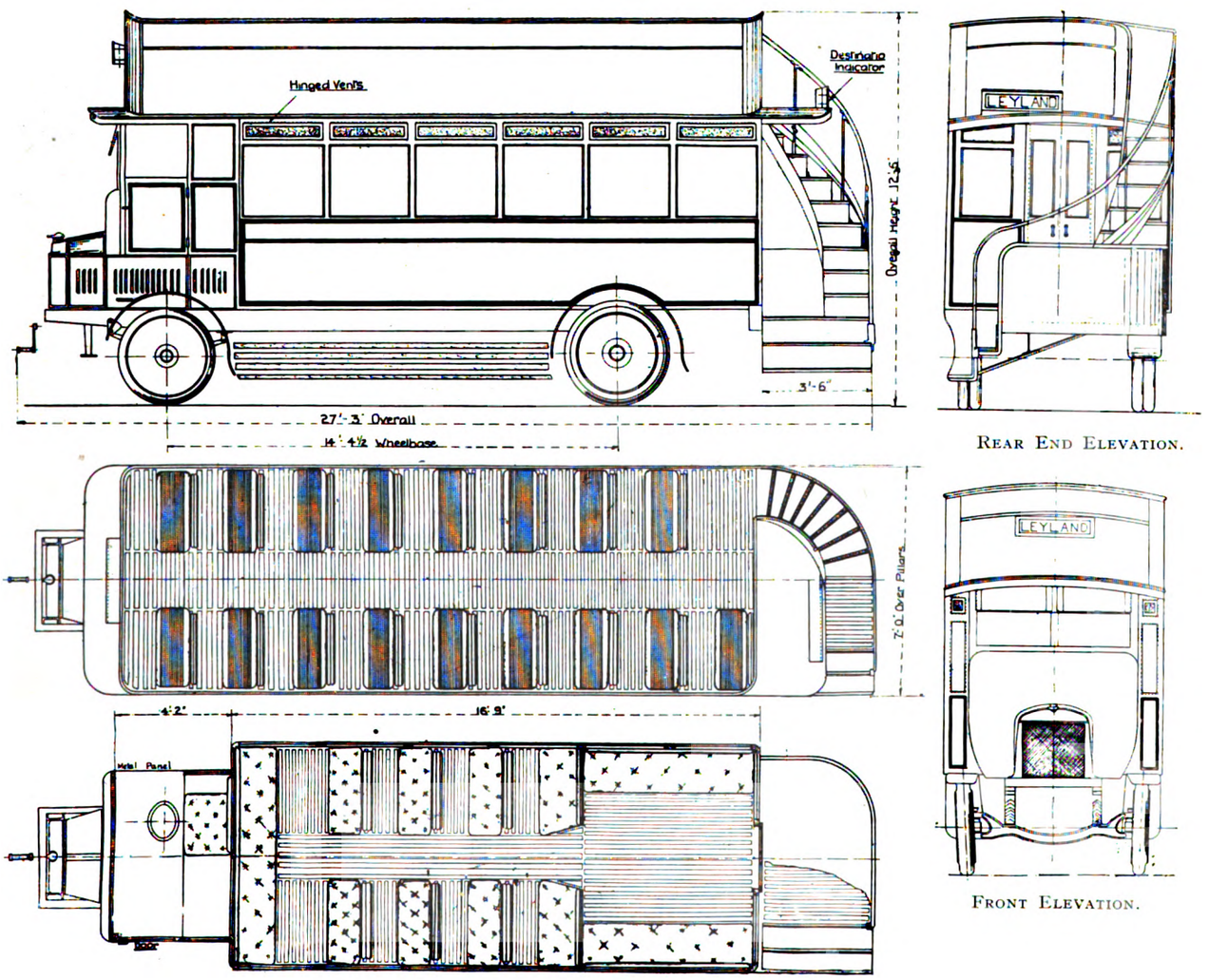

Leyland Omnibus Providing Seats for 63 Passengers.

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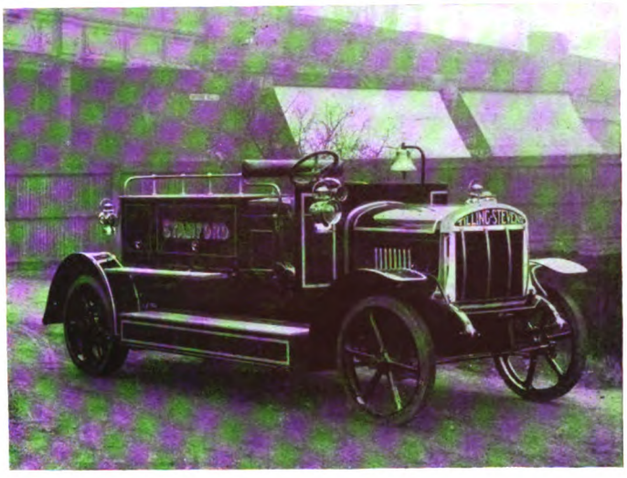
MOTOR TRAFFIC

TILLING-STEVENS FIRE TENDER.

The accompanying photograph depicts a recent delivery to the Stamford Fire Brigade of a Tilling-Stevens motor fire tender, supplied by Tilling-Stevens' Motors, Limited, of Maidstone. The body, a fine example of its kind, is mounted on a Tilling-Stevens T.S.B.4 gear-driven chassis, fitted with a drawbar coupling and other specialities. Chief among the uses to which this fire tender is put is that of drawing a steam fire engine. As a test of sturdiness



Stamford's Tilling-Stevens Fire Tender.

and reliability the vehicle was driven over a give and take route of six miles, carrying 13 men, and hauling the steam fire engine, weighing 2 tons 5 cwt. During this run the lower gear was not put into operation once. As a further test, the fire engine was uncoupled, and with the same complement of men a speed of 30 miles per hour was easily attained. The roads, during these tests, were in a greasy condition, a further reason why this should be considered a creditable performance.

LONDON OMNIBUS ENTERPRISE.

PARKING OF VEHICLES FOR THEATRE TRAFFIC.

With the approval of the police the London General Omnibus Company on December 29 initiated an experiment in parking omnibuses ready to move into the West End theatre region on the conclusion of the evening performance. At the outset only 70 omnibuses were utilised, but as experience is gained the number in a few weeks will increase to hundreds, thus enabling the West End to be expeditiously cleared of people on the look out for vehicles to take them home.

The test began with parking the omnibuses just before 10.30 p.m. in Great Marlborough Street, Soho Square, Lincoln Inn Fields, Aldwych East, and the Victoria Embankment at Charing Cross. A staff of regulators provided by the company despatched the vehicles from those centres.

The operation has been made possible by the rather long-delayed consent of Scotland Yard, and the recent re-arrangement of the spreadover of the employees, and it is anticipated that the plan will ultimately effect a considerable saving in fuel and labour, a result that is greatly needed in view of the continued high cost of operation.

It is not to be assumed that the omnibuses on the stroke of the clock swoop down upon theatreland. Except where a place of amusement is situated on an omnibus route there is no "invasion" by the parked vehicles, which simply augment existing services at the rush hour. It is a police stipulation that the concession shall not create congestion. The period of waiting at the parking places is very short; it is not to the interest of the company that the men and machines should be standing idle. Not the least benefit of the innovation is the relief likely to be afforded to the Underground Railways and to the congestion at the stations.

THORNYCROFT'S GOOD YEAR.

Sir John E. Thornycroft presided at the twentieth annual meeting of John I. Thornycroft and Company, Limited, held on December 19 at Winchester House, E.C. In moving the adoption of the report and accounts, the chairman said there had been a profit for the year ended July 31 last of £74,208, and in view of the conditions in existence during the year he thought they might congratulate themselves upon the results. They had brought into the accounts £53,169, and after payment of the dividend now recommended, they would carry forward £57,747 to the credit of next year's account.

Referring to the motor vehicle side of the business, the chairman said they had a good demand for spare parts due to the large number of their vehicles now in use, and for some years now they had been able to deal with the repairs on an extensive scale at the branches established in London, Leeds, Manchester, and Glasgow. All these branches were excellently equipped, and carried a large stock of spare parts so as to enable the company to supply promptly. They had agents all over the country stocking spare parts, and as they also ran a travelling inspection staff, he could confidently assert that no other commercial vehicle manufacturer had anything approaching such a complete scheme for giving service to the user. As to the class of vehicle produced by the company, it was well known that they had a great success as regarded war work, but this autumn they decided to enter their more recently produced 2-ton vehicle for a road trial under the observation of the Royal Automobile Club. They selected the route from London to Land's End, thence to Scotland, and then back to London, a total distance of £1,260 miles. The total weight with body and full load was 5 tons 6 cwt. 2 qr., and the petrol consumption 13 miles to the gallon, or 69·3 ton-miles to one gallon. No other manufacturer had produced a vehicle approaching this performance, and it was a great satisfaction to the directors when they were advised that the Royal Automobile Club had awarded the company "the Dewar trophy for the most meritorious performance of the year in any certified trial." The depression had been made a good deal worse for vehicle manufacturers by the continued disposal of the surplus war stock, but the company had had quite its full share of the sales that had been made, and they would continue to hold their own.

BRISTOL COMMERCIAL VEHICLES.

The illustration shown below depicts a 40-H.P. "Bristol" lorry supplied by the Bristol Tramways and Carriage Company, Limited, to Messrs. Challicom and Company, of Clevedon. The products of the Brislington motor works are built upon experience gained by the Bristol Tramways and Carriage Company in operating and

"Bristol" 40-h.p. Lorry, with Enclosed Cab.

constructing motor vehicles for many years past. This statement applies to both passenger and commercial machines. The company is particularly well situated for supplying any class of body. The advance made in the construction of lorry bodies is shown in the illustration. Nowadays very few lorries are without the enclosed cab for the driver, thus increasing the utility of the machine during the winter. This type can be had either as a permanent fixture or convertible into the open seat.

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MOTOR TRAFFIC

OMNIBUS SERVICES.

BIRKENHEAD.—In the event of the Lower Bebington and Bromborough Urban Councils not agreeing to the Corporation's proposal to run omnibuses to those places, the municipal authority will take steps to have the matter settled by arbitration.

BROMBOROUGH.—The local authority have informed Mr. J. M. Hudson, who applied for licences to run omnibuses, that the district is already efficiently served by the Crossville Motor Company, and that the road is too narrow and congested to permit of additional omnibus traffic.

CAMBRIDGE.—The Watch Committee have fixed the motor omnibus fare from the centre of the town, or the railway station to the Royal Show Ground at 9d.

CHESTER.—Mr. A. R. Fearnley, general manager of Sheffield Tramways and Motor Department, has advised Chester Corporation to continue operating their tramways, and to consider the question of utilising omnibuses to act as feeders. Mr. Fearnley states that if the Tramways Committee ran a motor omnibus service to one of the outlying districts in prolongation of the tramway route they would obtain valuable experience of the feeding properties of omnibus services. The experience of other districts in regard to this matter has been that omnibus services operated in the manner suggested have had the effect of converting non-paying tramway routes into paying routes, have added enormously to the value of the undertaking, and assisted in many ways to improve the travelling facilities which tramways can offer.

DONCASTER.—The Corporation Bill to be considered by Parliament asks for powers to run omnibuses inside and outside the borough. In view of the complaints of the fares charged by motor and other hackney carriage drivers on the occasion of the races, power is sought to make by-laws fixing the fares to be paid.

DURHAM.—For five days before Christmas the Northern General Transport Company reduced their fares for omnibus journeys in the northern part of the Durham county.

GLASGOW.—The Parliamentary Committee of the Corporation have received a deputation from the Commercial Motor Users' Association against the proposal to establish municipal omnibus services in competition with private traders, inasmuch as the Corporation would be able to apply the revenue of the tramways in meeting any loss incurred on the omnibuses. The committee, nevertheless, decided to proceed with the Bill seeking omnibus running powers. Six hundred residents of Newton Mearns have petitioned Glasgow Corporation to start an omnibus service from Eastwood Toll to Newton Mearns. The question has been referred to a sub-committee.

HULL.—Reporting on the recent reduction of fares on the Stoneferry omnibus service, the general manager has stated that the change is likely to result in a loss of £1,500 for the year.

JARROW.—A Bill has been deposited to enable the Corporation to establish omnibus services in the borough.

KEIGHLEY.—The Corporation are now running three Leyland single-deck omnibuses in place of the railless trolley cars on the Oakworth route. The decision was arrived at after a trial run of motor coaches.

LANCASTER.—The Watch Committee have granted permission to Mr. W. Wilson to start an omnibus service between Lancaster and Cockerham.

LINCOLN.—Added to a loss of £1,415 for the first six months' working, the Corporation omnibuses have had a further loss of £1,900 for the past half-year. It was stated at a meeting of the Council that when the undertaking was embarked upon it was known that there was certain to be a charge on the rates. The vehicles cost £17,638.

LONDON.—Lewisham Borough Council have decided to oppose the application of the County Council to Parliament for powers to run railless trolley cars from West Norwood, via the Crystal Palace, to Lee Green. The Borough Council suggest that the London County Council should obtain powers to run motor omnibuses. A special conference of the London Labour Party will be held in January to consider the programme of the party in the County Council election in March. One point is the public ownership of omnibuses, underground railways, and steamboats.

NATIONAL OMNIBUS COMPANY.—In their annual report the directors of the National Omnibus and Transport Company state that the services have been developed and extended. There is a profit of £26,930, which, with the amount brought forward from the previous year of £7,682, makes a total of £34,612. After transferring a sum of £15,000 to depreciation account, the directors, in view of the necessity for conserving cash resources, recommend that the balance of £19,612 should be carried forward. Mr. H. G. Burford and Mr. H. C. Merrett have been elected to the Board.

PERTH.—The Town Council have adopted the recommendation of the Tramways Committee to purchase an additional omnibus, the vehicle at present in use having frequently to carry 70 persons in place of the 32 for whom there is seating accommodation. Provided prices are sufficiently reduced, another omnibus may be bought during 1922.

SCARBOROUGH.—Messrs. Robinson's Motors, Limited, on January 2 started an omnibus service for Scarborough and district. Penny stages are given. Messrs. Seaton and Company also commenced running a service, though the tramway service remains in operation.

"Model 4" Omnibus of the Associated Equipment Company, Shown at Calcutta Exhibition in December.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

FOOD TRANSPORT.—Salford Health Committee recommend the Corporation to secure a by-law to ensure cleanliness of vehicles used for the transport of meat or other articles of food.

FORTY-FIVE MILE OMNIBUS RADIUS.—There are five omnibus lines running into Piedmont, U.S.A., from points within a radius of 45 miles. The fare from places 40 miles distant is 1·50 dollars per round trip.

WHERE THE OMNIBUS SCORES.—Ilfracombe Urban Council have granted a licence for an omnibus service between that town and Minehead. The journey will take three hours as against seven hours by railway with two changes.

MAILS BY LONDON OMNIBUSES. — The Postmaster-General arranged with the London General Omnibus Company for their omnibuses to co-operate in the distribution of the Christmas mails in the rural districts covered by the omnibus services.

A DAMAGED WEIGHBRIDGE.—A claim by the Glasgow Corporation against Mr. Carmichael for damage done to a public weighing machine by a motor vehicle beyond the capacity of the weighbridge has been amicably settled by a payment of £38 12s. 6d.

WORLD TOUR ON GIANT PNEUMATICS.—The Goodyear Tyre and Rubber Company (Great Britain, Limited), announce that the caravan in which Commander W. Weston is making a seven years' tour of the world is equipped with Goodyear giant pneumatic tyres.

SCALES FOR MOTOR VEHICLES.—In view of the greatly increased weight of traffic during recent years, Glasgow Corporation have asked a sub-committee to consider the whole question of the responsibility of the Corporation with regard to the maintenance of public weighing machines.

TEST OF A SIGNALLING DEVICE.—The technical department of the Royal A.C. have tested an arrow signal made by the Arrota Electrical and Motor Accessories Company, Limited, of Louth. In trials conducted on a car in the West End, both in daylight and at night, the device worked satisfactorily.

WHERE COACHES ARE WELCOMED.—The Commercial Motor Users' Association have been informed by the Ripon Corporation that they are desirous of attracting motor traffic to the city, including coaches. The association have supplied the Town Clerk with the addresses of their divisional secretaries in the north of England.

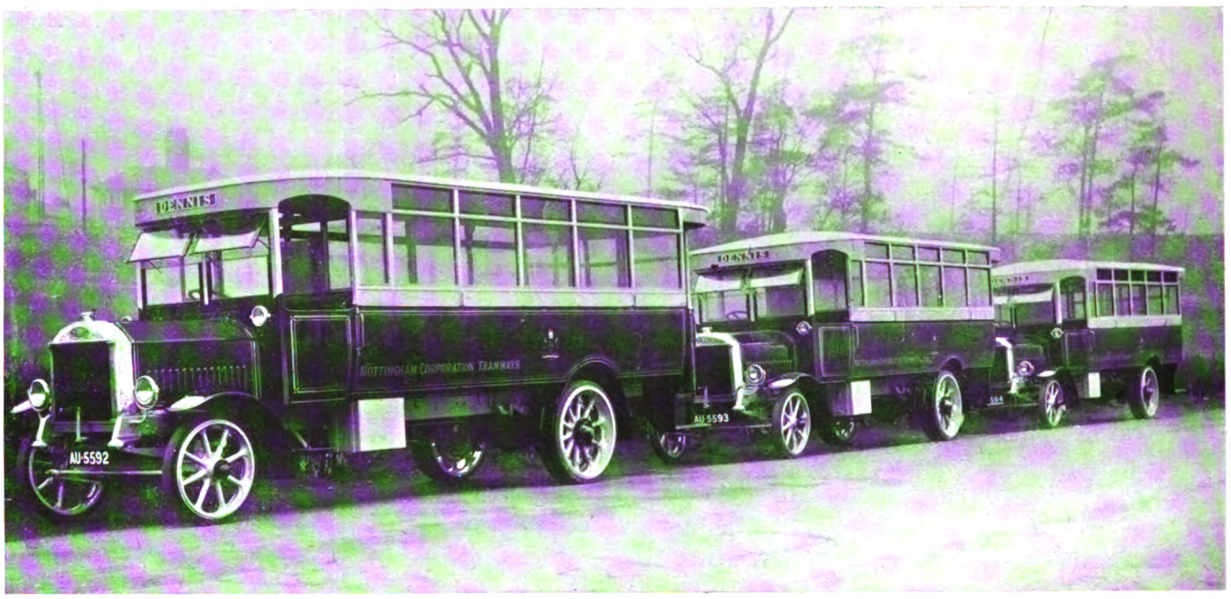
NO SPEED LIMITATION AT BURNLEY.—The Transport Ministry have refused the application of the Burnley Corporation for a speed limit for motors exceeding two tons (unladen) to seven miles an hour on part of the Manchester Road, being of opinion that any danger can be met by the provision of warning notices.

HAND WARMERS FOR DRIVERS.—In the United States electric hand warmers are placed over the inner side of the steering wheel of motor vehicles and clamped in place with a screwdriver. The current consumption is 3 amps. per hour on a 6-volt circuit. The manufacturers are the Rose Manufacturing Company, of Philadelphia.

SMOKE EMISSION BY-LAW.—Glasgow Corporation have asked a sub-committee to report on a proposal to include in the Corporation next Provisional Order a clause as to the penalty of emitting smoke from mechanically-propelled vehicles, providing "that such precaution shall be taken as will prevent the emission of offensive vapours from the combustion of fuels used for power purposes or from the vapourising of oil for lubrication."

MOTOR JOURNEY LOTTERY CHARGE.—A firm of London wine merchants were fined £125 and 20 guineas costs at Bow Street Police Court for publishing a proposal or scheme for the sale of chances in a lottery. The case concerned a competition in which £2,000 was offered in prizes to purchasers of wine who most nearly estimated the distance to be covered by a motor car travelling from London to Edinburgh and Glasgow, and back to London.

CHILDREN'S FARES ON LONDON OMNIBUSES.—Beginning on January 1 the London General and Tilling Omnibus Companies introduced the following scale of reduced fares for children under 14 years of age—1d. will cover the ordinary adult 1d., 1½d., or 2d. fares. 2d. will cover the 3d. or 4d. fares. For higher fares half the ordinary fare, fractions of a penny being charged as a penny. These special rates for children do not apply to cheap midday fares.



Single Deck 36-Seat 40-H.P. Omnibus built throughout by Dennis Bros. Ltd., for Nottingham Corporation Tramways.

MOTOR LORRIES REDUCE RAIL FARES.—As the railway company were charging 21s. per ton for conveying sugar from Greenock to Hamilton, the traders resorted to motor haulage at 17s. 6d. per ton. The railway company then reduced their rate to 14s. 6d. for a four-ton load, but very few merchants require so large a consignment. In order to compete with the road vehicles the local agents of the railway are asking that smaller lots should be accepted at same rate.

NO REMEDY FOR SLIPPERY ROADS.—The committee appointed by the Minister of Transport to inquire into the complaints of slipperiness of road surfaces, made arrangements with the County Councils of Worcestershire, Hampshire, and the North Riding to put down experimental sections of roads in three counties, at an estimated cost of £8,000. The Councils named contributed half of the cost, the remainder being borne by the Road Fund. Experiments in the shoeing of horses were also carried out. The committee have reported that no method of road construction or of surface treatment has been found which does not under certain climatic conditions become slippery for horses. The only immediate means of alleviating slipperiness is to incorporate grit with the tar, and to spread grit on such sections of roads as become unduly slippery. A large measure of safety for horses could be gained by improved shoeing, and by the adoption of rubber pads.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

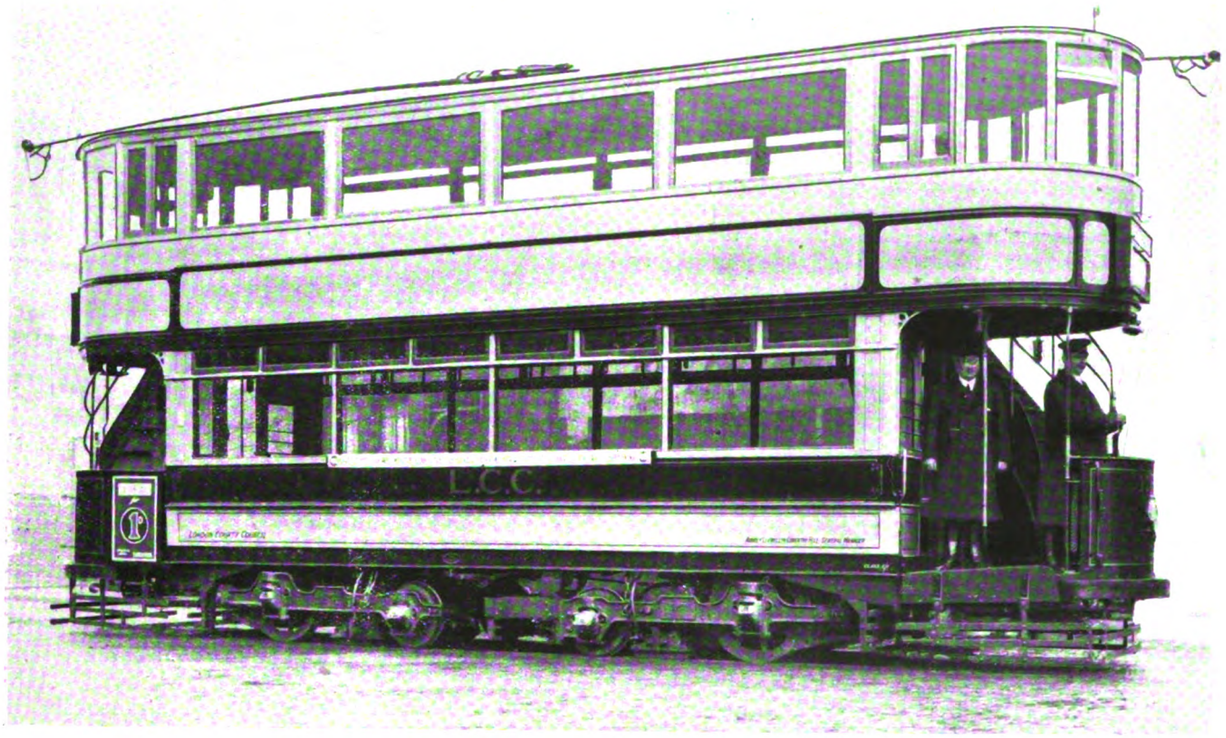
Founded 1892. LONDON, FEBRUARY 16, 1922. VOL. LI.

NEW CARS FOR LONDON COUNTY COUNCIL TRAMWAYS.

MOTORS OF 60 H.P. TO INCREASE TRAILER CAR SPEEDS—IMPROVED LIGHTING AND VENTILATION—PLATFORM GUARDS WITH SIDE AND FRONT OPERATION.

On January 27, members of the Highways Committee of London County Council and representatives of the Press had an opportunity of inspecting and travelling on one of the 125 new tramcars which are now being delivered. The party were taken from the Victoria Embankment to the central car repair shops at Charlton, and thereafter to the power station at Greenwich. Everything worked smoothly and the new car's capabilities were much admired. At the time of the inspection about a dozen of the new cars had been delivered. Out of the total, 75 car bodies are being built by the Brush Electrical Engineering Company, Loughborough, and 50 by Hurst, Nelson and Company, Motherwell. The electrical equipment of 75 of the cars was made by the English Electric Company, and of the other 50 by the Metropolitan-Vickers Electrical Company.

In general appearance the new cars are similar to the familiar two-bogie, double-deck, roof-covered cars seating 78 passengers each (32 on the lower and 46 on the upper deck) with which the metropolitan public are familiar. There are, however, various improvements in detail.



New London County Council Car—At the Right the Step is seen Raised with the Side Guard in Position.

These cars have been designed specially to suit the particular conditions of traffic which have to be met in dealing with the requirements of London's tramway travelling passengers during the rush hours of each working day between about 7.30 and 10 o'clock in the morning, and 4.30 and 8 o'clock in the evening.

They are equipped with motors of greater horse-

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power than those which have been previously used, in order that with equivalent loads of passengers, proportionately higher average rates of service speeds may be assured on the particular routes to which the cars are allotted for service. Provision is made on each car to permit of its use for drawing a trailer car, and when so used it is anticipated that the increased rate of service speed which is obtainable with the new motors will be especially marked.

In regard to dimensions, they are practically identical with the majority of the bogie cars already in use on the undertaking. The clearances available under certain bridges which have to be negotiated (especially when the cars are, as is now the case, fitted with trolleys in addition to plough gear, to permit of inter-running over routes constructed on either the slot conduit or overhead line systems of traction), are not such as to allow much variation in the way of increased dimensions.

The principal dimensions are as follow—

	Ft.	in.
Length over fenders	33	10
Length of main body over corner pillars ...	22	2
Width over guard rails	6	10
Extreme width over roof drip rails	7	2
Width over body framing	6	8
Height from rail to top of roof (outside) ...	15	7¼
Extreme overall height from rail over trolley equipments	16	1
Height from floor to ceiling, lower saloon ...	6	3
Height from floor to ceiling, upper deck ...	6	2
Height from rail level to top of fender (buffer height)	2	3¾
Extreme wheel base	14	6
Centres of pivotal points	13	4
Centres of body bolsters	10	6

The bodies are built upon steel underframes of the deep plate side girder type, composed of rolled and pressed steel members, all rigidly riveted together, except in cases where considerations of repairs render their prompt dissembly and re-erection in a running depot a matter of desirability, in which cases machined fitting bolts are used. The body bolsters and side rubbing plates are of new designs, each of which consists principally of two pressed steel joists or girders of an approximately fish-bellied form, braced and riveted together in such a manner as to enable a number of other smaller unit parts, previously used, to be dispensed with. This new type of bolster is made of such dimensions as to ensure its interchangeability as a complete unit with those on the existing cars, for which it will accordingly be used in future when replacements are needed.

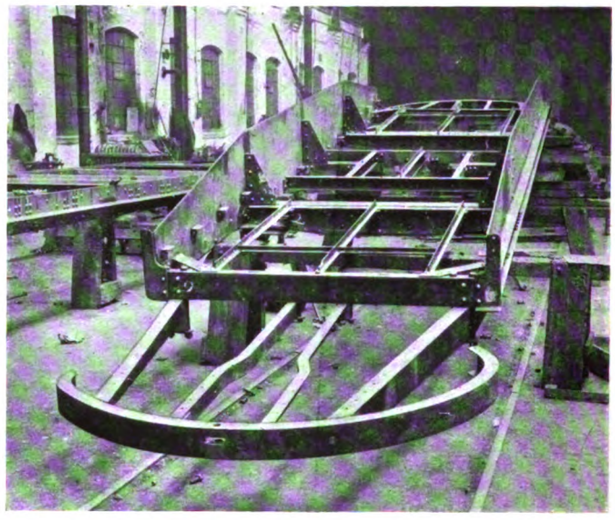
The platforms are constructed principally of rolled angle and channel steel bars, which are assembled into complete units independently of the main frame, to which they are secured by an arrangement of stirrup plates with shearing points in specially located rivets and packing plates, all so arranged that in the event of a collision the platform will carry away clear from the main frame, with a minimum of damage or distortion to the latter.

The framing of the bodies is carried out, so far as the majority of the members is concerned, in high grade Moulmein teak, with the addition of specially selected straight grained pitch pine in the case of certain of the longitudinal members for which in practice it has been found to be suitable.

The roof sticks, bends and some other framing members, which are well protected from possibility of dampness, are fashioned from tough ash, and the whole securely tied and bound together by steel flitch plates, tie rods, corner knees and rolled steel car-lines of angle section, as necessary.

The exterior panelling of the cars is, so far as the lower saloons are concerned, of Honduras mahogany, and on the upper decks of steel sheeting arranged in such a manner as to provide a definite cantilever construction for supporting the ends of the top covers above the platforms, without any necessity for the interposition of adjustable truss rods. The interiors of both the lower saloons and upper decks are finished generally in accordance with the standard practice, in wainscot and quartered oak, with ash seats and alternate maple and walnut coloured casings, arranged to give a pleasing contrast in appearance from point to point. The ceilings are composed of narrow slotted boards finished to a white enamel surface, this being an innovation which follows upon a series of experiments devoted to an equalisation of the artificial lighting throughout the cars, which has recently been carried out. The actual lamp reflectors are, so far as tramcar lighting is concerned, of new types, which have been made by the Benjamin Electric Company, Limited, to the Council's requirements.

Speaking generally, the majority of the service



Steel Under Frame of L.C.C. Car with Deep Plate Side Girders.

fittings provided on the car bodies are similar to those previously used, the principal modifications being in connection with the steps and lifeguards, which are combined together in a design produced by the rolling stock engineer, Mr. W. E. Ireland, to give the advantages in the case of the guards of both side and front operation, together with the maximum clearance under the leading platform of the car, when the step is lifted and the guard brought simultaneously into action and positively locked by direct movement of one handle.

The object is to furnish the maximum of protection to passengers and pedestrians. On the front end of each car, according to the particular direction in which it is travelling, the steps and adjacent fittings are lifted so far above the normal position as to give a practically clear way between the front of the vehicle and the picking up or safety tray of the lifeguard, with the exception of the slatted gate swinging screens incidental to the operation thereof, which are now arranged to bring it into use when an obstruction is met with from the end or from either side of the vehicle.

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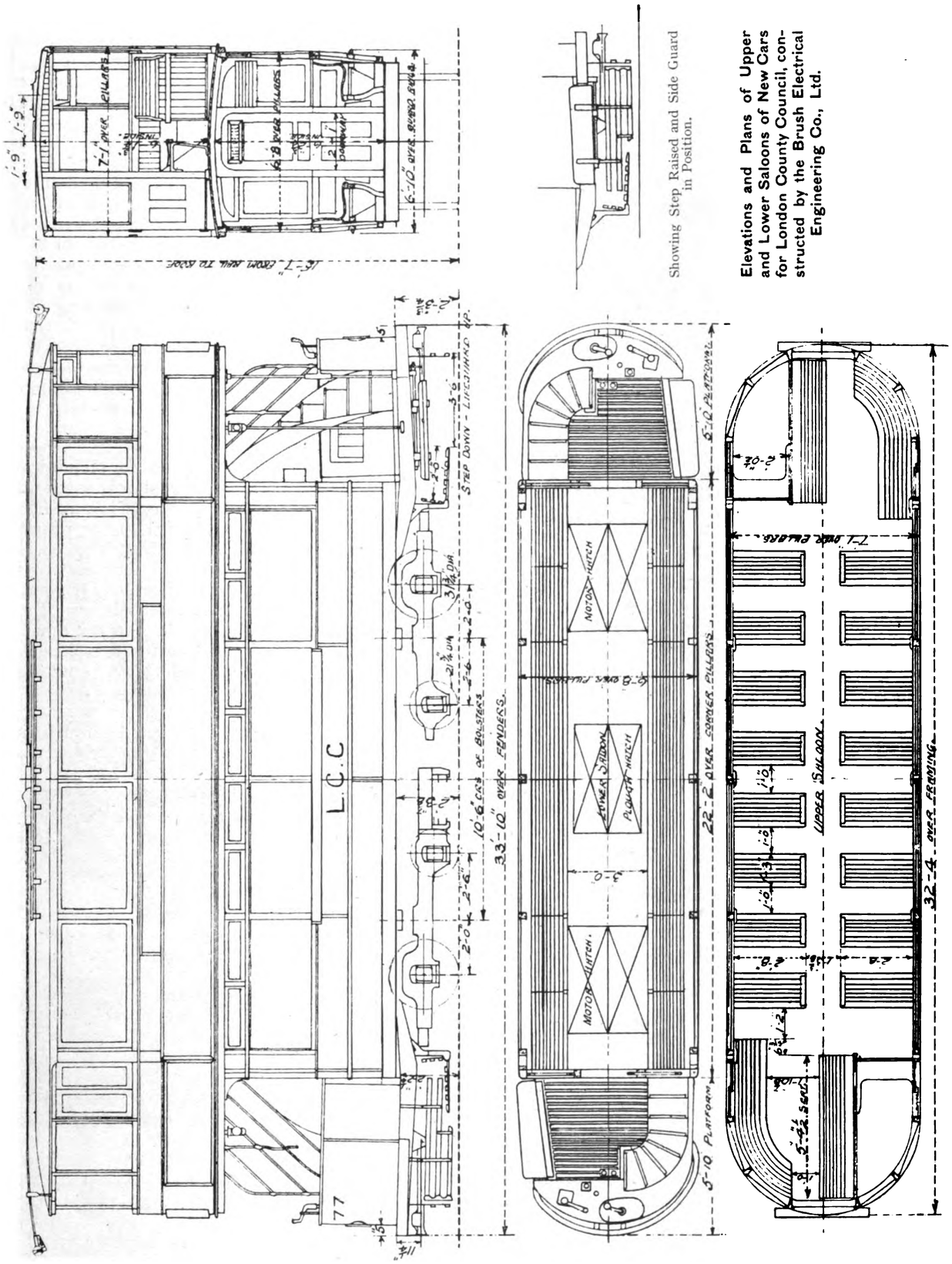

Showing Step Raised and Side Guard in Position.

Elevations and Plans of Upper and Lower Saloons of New Cars for London County Council, constructed by the Brush Electrical Engineering Co., Ltd.

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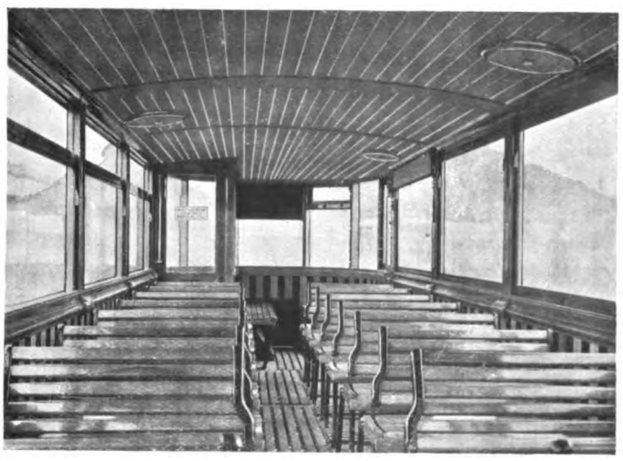
Improvements have been effected in connection with the ventilation of the cars by fitting in the lower saloons a set of sharp angled louvres over each of the end drop windows, so that these can be open, even in bad weather, and assure a regular flow of fresh air through the full length of the vehicle, without the passengers being subjected to direct draughts. For the upper decks, a generally similar effect has been produced by extending the roof side protection or weather strips some inches downward, to cover the



View of Interior of Upper Saloon.

joint line between the moveable windows and the roof rail, and fitting stops to ensure a gap of some three-quarters of an inch being permanently left between the two faces, which is screened from ingress of wet, etc., by the deep weather strip. This ensures an even flow of fresh air across from side to side at the ceiling level. As the upper deck forms the smoking compartment of each car, a number of air outlets or extractors are fixed over the ceiling lamps, these being the points at which heated air and smoke is found in practice most freely to accumulate.

The sanding gear, which is fitted to serve each of the four driving wheels, is arranged to give a direct flow of sand through a vertical pipe at the underside of each hopper, the flow being controlled by a semi-rotary guillotine valve, fixed in the horizontal plane and operated through a rack and pinion by the backward or forward movement of the connecting rod, as actuated by the motorman's foot pedal. The cars are all fitted with coupler gear, with a view to their use for drawing trailer cars.

Hand brakes are fitted on each platform, but not for general use as service brakes, the function of which is performed by the magnetic track brakes, with mechanical wheel block attachments, which have been standardised for many years as the service brakes on all the Council's cars.

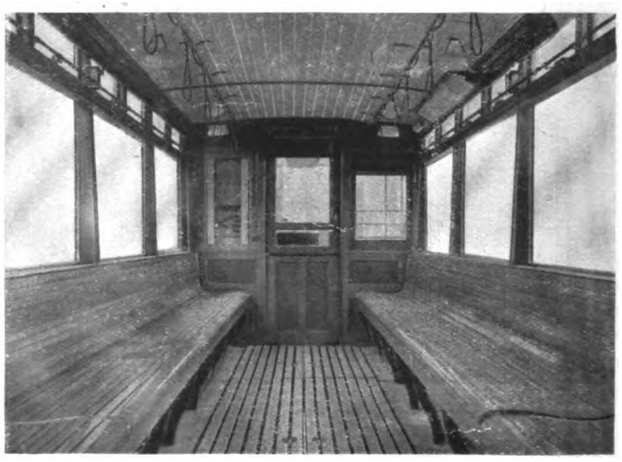
The trucks are of maximum traction type, with swing bolsters, so arranged that approximately 65 per cent. of the total vehicle weight is carried on the driving wheels and 35 per cent. on the trailing or pony wheels. They are constructed principally of steel castings, made in accordance with the Council's specification, to show under test a tensile strength of from 30 to 35 tons per square inch, with an elongation equivalent to 10 per cent. in 2 in. They are tied together transversely by rolled steel transoms and sills of channel section, all secured by machined fitting bolts, to provide for prompt replacement of damaged or worn parts at any time, as requisite.

The driving wheel axles are of steel, finished all over to a parallel diameter of 5 in. over the wheel seatings, and thence reduced to $3\frac{3}{4}$ in. diameter at the journals. The trailing wheel axles are of similar material, but left black, to a diameter of $3\frac{3}{4}$ in. between wheel seats, at which points they are finished to $3\frac{3}{4}$ in. diameter, and thence reduced to 3 in. diameter at the journals.

Tough steel castings are used for the wheel centres in each case, finished respectively to $27\frac{1}{2}$ in. and $17\frac{1}{2}$ in. diameter, to take tyres of high carbon steel, turned to outside diameters on the treads of $31\frac{3}{4}$ in. and $21\frac{3}{4}$ in. respectively, which are heated and shrunk into position on the centres, to which they registered for transverse location by a stepped edge, which is machined on one side and a burr or ring of metal, which is reeled over by a special tool, on the other. A grooved ring is cut in each of the centres, which serves as a datum for locating the device used at regular intervals during the service life of the vehicle for the purpose of determining and recording from time to time the amount of wear or possible distortion in sectional tread outline of each tyre.

Both types of axle boxes are cast from specially tough soft cast iron, and are arranged for oil lubrication in conjunction with packings of wool or worsted waste, the bearings used being of a high-grade anti-friction yellow bronze, each properly fitted to the respective journal. Spring-secured segmental guards, consisting each of several laminations of sheet fibre, are provided at the back of each journal and effectively prevent the ingress of mud, dirt, or water to the boxes. One of each set of trucks is provided with brackets and channels for the special purpose of supporting the plough and collector gear used when travelling over routes constructed on the conduit slot system.

The motors, of which there are two per car, are mounted one on each truck, connected through single reduction gearing on to each of the driving axles.



Interior of Lower Saloon.

They are designed to develop a mechanical output up to 60 H.P. each, to be capable of accelerating the loaded car at a rate of 3 feet per second per second up to a speed of 12 miles per hour, and to give a tractive effort of 1,600 lb. at the periphery of the driving wheels. This increased capacity of the motors, in comparison with those already in use (42 H.P. per motor) has been provided more especially for enabling the cars, on congested routes, when drawing trailers, to maintain

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their respective stations in relation to cars of the older types which are not so employed in drawing trailers. The new car with trailer and the old car without trailer accelerate equally at 2 feet per second per second.

The controllers, with circuit breakers and canopy switches, are all designed to suit the conditions of operation which have to be met in connection with the London tramway undertaking, which is constructed mostly on the underground conduit slot system of traction (on which the polarity of the conductors may be varied from point to point and pole to pole, on any section of track), partly on the ordinary overhead line system and to a small extent in the vicinity of the Greenwich Observatory on the double (insulated return) overhead line system, and also for control of the service (magnetic) brake.

The cars are finished, so far as the external appearance is concerned, in the Council's standard colours of rich crimson lake (Midland red) and cream, with gold letterings and lines, with the exception of such parts as are more especially subject to wear and tear, which are usually picked out in black, to permit of ready renewal when necessary, without interference with the main finish of the vehicle.

With a view to the more rapid reversal of these cars at the outer terminal points of routes which are operated on the overhead system, each car is provided with two trolleys, the arms of which are kept pointing towards opposite ends of the car, so that the conductor, at the end of such a journey, will simply need to pull one trolley down from the wire, and secure it, and release the other into working position, instead of having to swing the arm out across the roadway and guide it back to the other end of his car, across intervening traffic, as is necessitated with the older arrangement. The delivery of the new cars will increase the total number to 1,792, making, with 158 trailer cars, a total (passenger carrying) fleet of 1,950 vehicles.

Bristol Pedestrians to "Keep To The Left."—Bristol Watch Committee has directed pedestrians to keep to the left on the pavements of the city. In a statement by Sir J. Swaish, chairman of the Committee, the fact was noted that many serious accidents occur through pedestrians stepping from the kerb into the roadway without noticing some rapidly overtaking and almost silent motor or other vehicles. In passing from the left of the pavement the pedestrian will have full opportunity of noticing oncoming vehicles.

ONE-MAN TRAMCAR IN LONDON.

INTERESTING EXPERIMENT ON SUBURBAN ROUTE.

If the amount of interest which has been aroused by the introduction on the London United Tramways at Kingston of a one-man safety car is to be any criterion of its general popularity, the success of such a type of vehicle is assured. Mr. C. J. Spencer, the general manager, has rendered a notable service to the development of the one-man car principle in launching this experiment, and his efforts to prove the practical utility of one-man operation are being closely watched. The need for an appreciable reduction in working costs is understood to have been partly responsible for the innovation, and judging from the results obtained in the United States from the large number of such cars there used, a material saving should be effected. It was in America that Mr. Spencer gained much of his knowledge of the one-man car, of which he has made a special study. The present vehicle cannot, however, be described as typical of the American type of safety car. The body is a standard single-deck type, reconstructed to the Company's designs, in their own shops, to suit one-man operation. Vestibule fronts have been fitted, and the seating capacity, in the car's new form, is 30.

One-Man Tramway Car—London United Tramways, Ltd.

While driving, the motorman is seated in the body of the car, in a similar manner to the modern cabriolet motor car, with an open railing behind him, as shown in the accompanying photographs. The entrance is fitted with sliding door and folding step, working in conjunction with each other and operated by means of a lever by the driver. An electrical device prevents the car being moved when the door is open. An electrically operated "Automaticket" machine (such as was described in our issues of Jan. 19 last and May 19, 1921), is fitted at each end of the car, by means of which the motorman can issue from one to five tickets of any denomination by pressure of a button. Passengers board and alight at the front end of the car and pay their fares on entering, the rear door being locked. Improved methods of issuing tickets so as to operate with one roll of tickets and to deal with any length of route have been considered and

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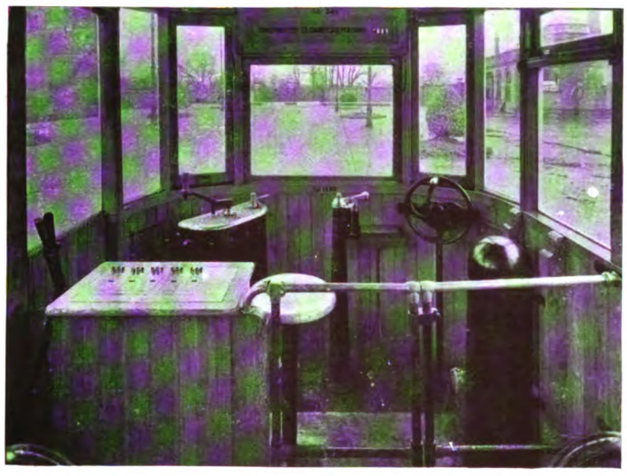
a scheme evolved with which it is hoped to experiment at an early date. Mechanical means of giving change are also embodied in this scheme.

The body is mounted on a single Brush truck of 8 ft. 6 in. wheel base, with flexible axle suspension. The wheels are of 33 in. diameter, and the car is fitted with the Spencer-Dawson hydraulic track brake.



Motorman's Compartment of One-Man Car.

This is an invention of Mr. Spencer, which he introduced on the Bradford Corporation system when he was manager there, to ensure additional safety on the steep inclines which are to be met with in that city. In order, however, to provide the necessary "deadman" handle feature, so that the car is automatically stopped in the event of sudden illness of the motorman, the brake handle is arranged to be held normally in the "on" position by means of a spring, and in this position power is cut off from the controller.

Passenger Entering One-Man Tramway Car.

To save the motorman having to take the pull of the spring in the "off" position, the handle is fitted with a light spring catch held in position by the weight of his hand, but the handle is immediately released when pressure is removed. The ordinary rheostatic and hand brakes are also installed. In order to allow of tripping circuits for the doors and deadman's handles, the controller has been arranged in conjunction with a contactor which is carried on the roof of the car. The pick-up coil of the contactor operates with one ampere and is closed on the first notch, but will not close or remain open on any notch if the circuit is broken at either door switch or brake handle. A "Road Guide" device, supplied by Messrs. Road

Motorman of One-Man Car Issuing Ticket to Passenger.

Guides, Limited, is fitted on the car. This is driven off one of the axles and automatically shows passengers the position of the car at any moment and the route half a mile ahead.

As will be seen from the illustrations, the exterior of the car has a pleasant appearance. A strong headlight is mounted on the end of the roof, above the motorman's compartment, and is so inclined that its rays bear down on the track. Notices painted on the panels adjoining the doors advise intending passengers to "Please have exact fare ready" and "Please pay as you enter car." A rather ornamental poster, mounted on a narrow board extending along the greater part of the edge of the roof, bears the motto "Always be careful," flanked by the familiar "Safety First" signs. In addition to the ventilation afforded by the small hinged windows above the main side windows, fresh air may enter through an adjustable screen, opening outwards, in the front of the driver's vestibule.

JUBILEE OF DUBLIN TRAMWAYS.

A NOTEWORTHY TRIBUTE TO THE SYSTEM.

February 1 marked the jubilee of the inauguration, by the Dublin United Tramways Company, of the tramway from Nelson's Pillar to Rathmines and Terenure. The *Irish Independent*, commenting on the anniversary, says—

"One of the greatest benefits bestowed on Dublin in the last half-century was the introduction of the tramway system. It completely revolutionised locomotion and travelling in the city, and gave the long-needed impetus to the opening-up of the suburban areas as residential quarters. The linking-up of these districts (Rathmines and Terenure) with Dublin was the prelude to a period of remarkable activity in the building trade, and thousands of attractive and commodious houses owe their erection to the enterprise of the tramway promoters.

"For many years the tramway cars were drawn by horses, but finally electricity was utilised, and in May, 1906, the electric tramway from Haddington Road to Dalkey was formally opened by the Lord Mayor of Dublin, the Right Hon. R. F. McCoy. The electrification of the whole Dublin tramway system followed, with results that are known to every citizen."

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SIX-WHEELED RAILLESS OMNIBUS AT BRADFORD.

The general manager of Bradford Corporation Tramways, Mr. R. H. Wilkinson, has carried a step further his activities in developing the railless trolley omnibus by designing the six-wheeled vehicle shown in the accompanying illustrations. Several types of trolley omnibuses have, in fact, been constructed to his designs for the Bradford system, and it will be recalled that Mr. Wilkinson was responsible for the production of the first double-deck type to be used in this country, as illustrated in our issue of November 18, 1920. Two later railless models of his were described and illustrated in our issue of April 21 last year—a "one-man" vehicle and a six-wheeled, double-deck omnibus.

The vehicle here pictured has seating capacity for 59 persons. The front portion of the upper deck is not at present utilised for passengers, but it probably will be after the omnibus has been in service for some time, in which case its seating capacity will be increased by at least six. The vehicle will very shortly be going into service, the delay (at the time of writing) being caused by the non-delivery of the motor and controller. The omnibus has a single motor drive of 70 H.P. with a foot-operated controller. There are three methods of braking, as follows—

(1) A brake operated by the foot on to the counter-shaft and so to the back wheels.
(2) By side lever operated by hand, which brakes both the back wheels and the rear front wheels.
(3) The ordinary electric brake, operated through the controller.

The wheels are 3 ft. 4 in. in diameter, the back wheels being fitted with twin solid tyres. Fifty per cent. of the weight of the vehicle is on the back axle, and the remaining 50 per cent. is distributed equally between the two front axles. The vehicle weighs seven tons complete (without passengers), and the weight is distributed equally over eight tyres. The front axles are fixed, and are not arranged on the bogey principle. The wheels alone move and are steerable, the four front wheels being connected by the one steering shaft. These wheels are mounted on stub axles in the usual manner. The somewhat similar type of vehicle with four wheels, which has been in operation since November 6, 1920, has run approximately 40,000 miles.

The Bradford Corporation are promoting, in the present Parliamentary session, an order to run trolley omnibuses over a number of their tramway routes, having in view extensions outside the city. The object is to enable a through service to be given from the centre of city to out districts, without breaking the journey.

Six-Wheeled Railless Trolley Omnibus—Bradford Corporation Tramways.

SCOTTISH TRAMWAYS ASSOCIATION.

Further steps have now been taken in the formation of the Scottish Tramways Association, to which reference was made in our issue of January 7. Following the meeting there referred to, a second conference took place last week in Dowell's Rooms, Edinburgh, when Mr. L. MacKinnon (deputy general manager, Glasgow Corporation tramways), presided in the absence of Mr. J. Dalrymple. A draft constitution was prepared, and other arrangements made for a further meeting to be held in Edinburgh. It is intended to hold periodical meetings for the consideration of matters relating to Scottish tramways in general.

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THE "BURNLEY" TRUCK.

The "Burnley" truck, which is shown in the accompanying illustrations, was produced at Burnley by Mr. Henry Mozley, general manager of the Burnley Corporation Tramways, and his staff. The truck was specially designed for use on heavy gradients, and it has many useful features. It was first used in 1910, and has been in service for many years. It may therefore be said to have stood the test of time, and it has been found very satisfactory as to smooth running and in the way it has withstood the somewhat exacting conditions on steep and worn tracks. On one route on which the large single-deck cars run there are gradients of 1 in 10, and on another there is a long length as steep as 1 in 11·9.

The principal disadvantage of the maximum traction type of truck is the difficulty of braking effectively very high speeds, and generally it may be said that the ordinary types do not accelerate nearly as well as the four-wheel car. For this reason the ordinary maximum traction truck is not so suitable for use on considerable gradients as the four-wheel car. The maximum traction truck of the Burnley design, however, lends itself very favourably to the use of the Maley electro-mechanical rail brake, which is manufactured by the Electro-Mechanical Brake Company, Limited, of West Bromwich, who have introduced several improvements in the Burnley design of truck. The Birmingham Corporation Tramways have in service 125 cars equipped with the Burnley type of truck and the Maley electro-mechanical rail brake. These cars, with passengers, weigh as much as 19 tons, and are run at very high speeds, probably as high as any in the country, on gradients as steep as 1 in 13, and they have been doing this service for over seven years. The weight of the car body is carried over the centre of the driving axle, so that as much as 80 per cent. of the car weight is utilised for adhesive purposes in accelerating or braking. The acceleration even on greasy rails is practically as good as that obtainable from an ordinary four-wheel car. It might be thought that owing to the large proportion of weight carried by the driving wheels there would be a tendency to skid, with consequent flattening of the pony wheels when using the hand brake, but this is entirely avoided by a new design of compensating link which has proved very successful.

The mechanical details of the truck have been carefully worked out. The main crossbar is spigotted into the side frames, ensuring accurate assembly and maintenance of alignment under all conditions. All pins are case-hardened 1-16th in. deep, and all holes are bushed. The king pin, through which the drive of the truck is transmitted to the car body, is carried in a phosphor bronze bearing, which in turn fits into a radiussed frame. This allows the car to pass over the worst hog-back bridge or track without imparting any bending strain to the king pin or transmitting shock to the car body. The centre pin is carried by a stiff cast-steel bracket which is placed exactly over the centre of the driving axle, and is part of the truck and not on the car under-frame. Owing to this arrangement the driving wheels have no lateral motion in relation to the car body. This tends to keep down flange wear and it provides a central drive, the axles always being approximately radial to the curve. The centre pin engages in a die sliding in a box and controlled by a spring. One inch of movement on each side of the centre is allowed. The adjustment is such that the riding of the car is similar to one mounted on a swing bolster. The body is carried on spring-mounted saddles on each side of the frame, fitted with wearing plates sliding on grooved steel angles bolted to the side sills of the car underframe. The pony wheels have a wide range of travel under the sills of the car, but, owing to the comparatively small weight they carry and the great leverage they possess, the swivelling of the truck is very easy and the flanges keep in good condition. A little extra pressure is added for curves of small radius, and the ease and freedom with which these trucks take the car over curves with a radius of 20 ft. is noteworthy. The body really floats on the truck, and this accounts for the exceptionally smooth running.

The renewable horn plates are of channel section, and much more substantial than is generally the case. All brake spring nuts are self-locking; the driving wheel axle box keeps are bolted up from the under side, forming an integral part of the frame, a method of construction which imparts great additional strength.

The results obtained from the Birmingham cars fitted with this equipment have been excellent. Maintenance costs, we understand, are actually less than on the four-wheel cars, although during the war these heavy cars running on busy routes were handled in many cases by temporary drivers, and owing to the shortage of men the maintenance of the trucks could not be kept up to peace time standards. When the traffic calls for large cars to operate at high speeds on busy routes, there is no doubt that this combination of trucks and brakes will give very satisfactory results, and this on gradients for which ordinary maximum traction trucks are unsuitable owing to low adhesion. If desired, the trucks can be supplied without the Maley electro-mechanical rail brake.

On narrow gauge lines the bogie car is practically the only economical type of car, owing to the small carrying capacity of the four-wheel car. Apart from the financial side of the question, the end oscillation of four-wheel cars on narrow gauge lines is most objectionable, and up to the present no permanent cure has been discovered for it. This end oscillation, or "tail wagging" as it is sometimes called, is also met on standard gauge lines, but it is not so pronounced, of course, as on the narrow gauge. Obviously, as the bogie truck eliminates end oscilliation, it is an additional argument in its favour. For single-deck cars the Electro Mechanical Brake Company, Limited, supply the "Burnley" truck in a lighter design.

The findings of the "Corrugation" Committee raise an important objection to "maximum traction" trucks, inasmuch that the pony wheels promote corrugation because although only carrying a minor part of the load, owing to the reduction in their diameter, the rails are more heavily stressed than in the case of the driving wheels. This criticism will not apply to the "Burnley" truck, where the weight carried by the pony wheels is so much less than is carried on the pony wheels of maximum traction trucks of ordinary design.

Sequel to Burton Tramcar Mishap.—Alluding to the recent overturning of a Burton-on-Trent tramcar, in consequence of a broken axle, Alderman J. S. Rowland (chairman of the Tramway Committee) informed the Council that the numerous level-crossings imposed a greater strain than on most systems. Experiments were being made, and the committee were prepared to adopt the very best axle obtainable and substitute it throughout the cars, whatever the expense might be.

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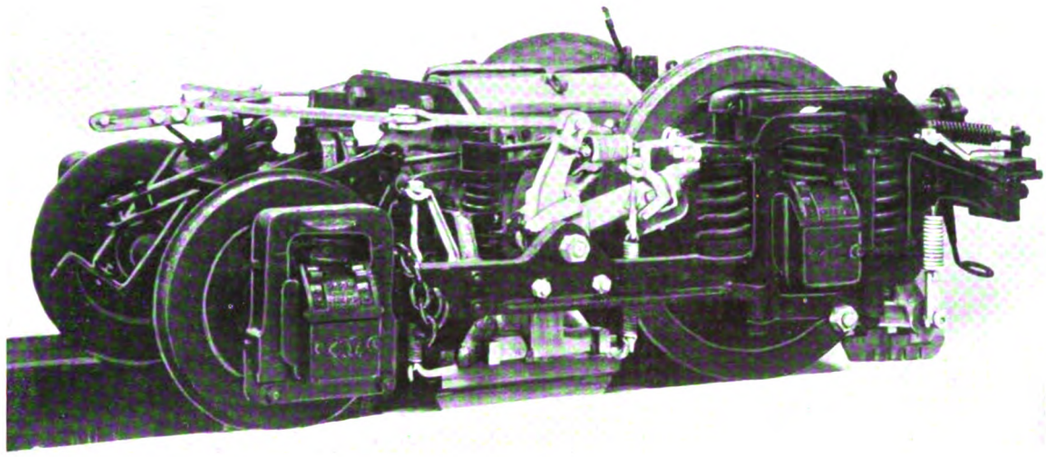
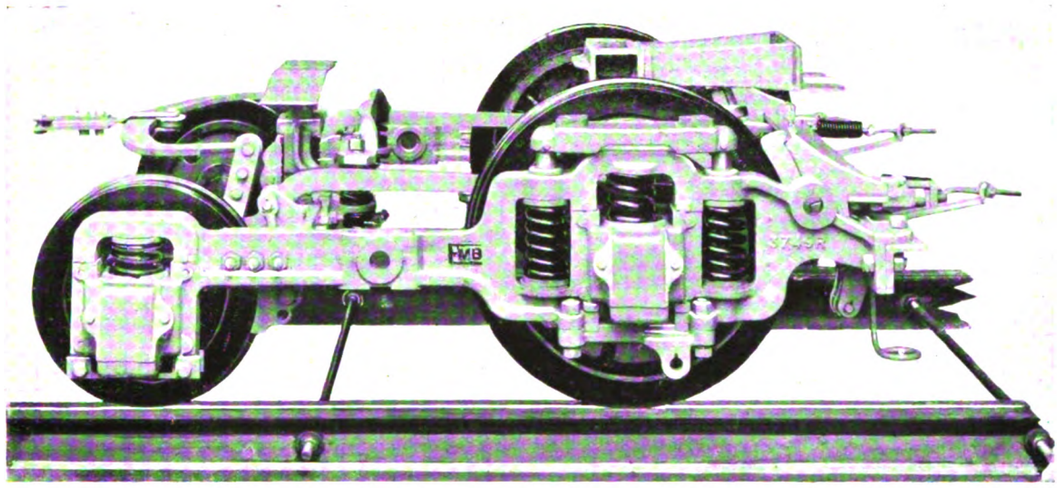
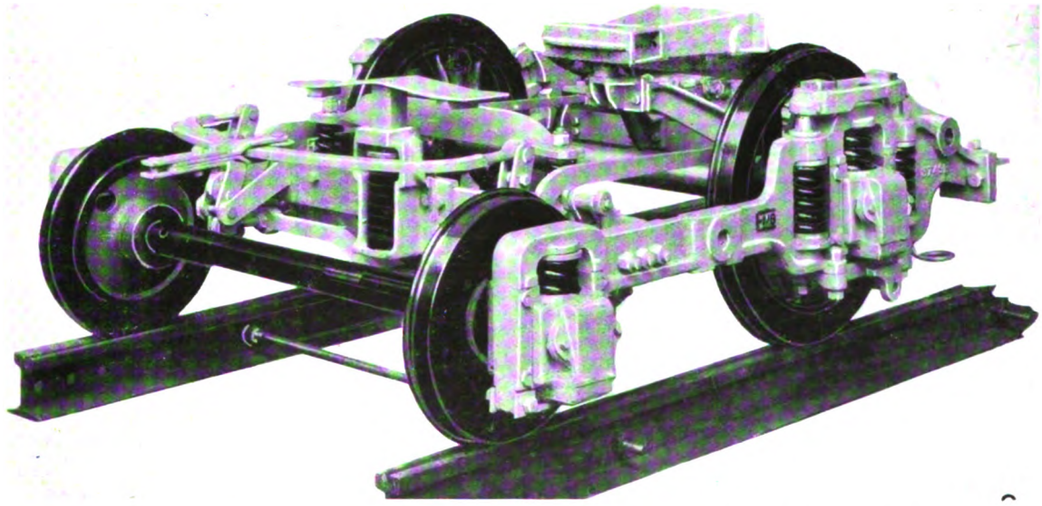


"Burnley" Bogie Truck (Brush Electrical Engineering Co.'s Manufacture) Equipped with Electro-Mechanical Rail Brakes by the Electro-Mechanical Brake Co., Ltd.



Side View of "Burnley" Bogie Truck.



Views of the "Burnley" Bogie Truck Manufactured by the Electro-Mechanical Brake Co., Ltd.

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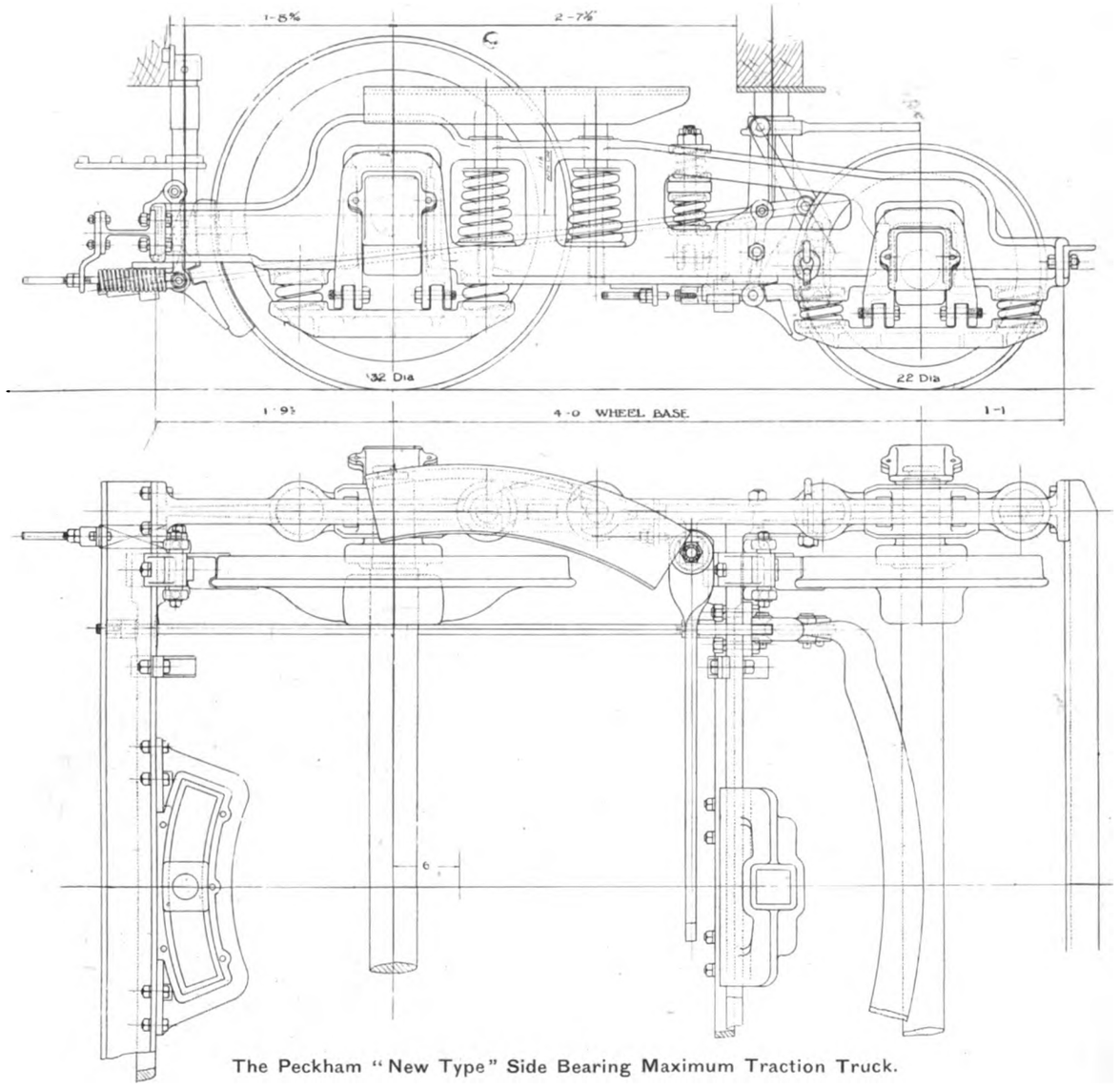
THE PECKHAM "NEW TYPE" SIDE BEARING MAXIMUM TRACTION TRUCK.

Many types of maximum traction trucks have been designed and tested during the last 25 years with varying success. The two chief types now in general use are of the swing bolster and the side bearing design. With a view to obtaining a perfect riding car, The Peckham Truck and Engineering Company, Limited, of Audrey House, Ely Place, Holborn, London, E.C.1, collaborating closely with the Brush Electrical Engineering Company, of Loughborough, have designed the truck shown in the accompanying drawings, and it embodies the features of both types mentioned above but with many improvements.

This truck, which will be known as the Peckham patent new type side-bearing maximum traction truck (P. 26) is of the side bearing type as far as the mounting of the car body is concerned, but with the Peckham patent pendulum gear mounted on each axle, lateral movement is provided which gives the same flexible movement to the car body as the swing bolster type of truck. It possesses, however, this considerable advantage, viz., that each pair of wheels is able to get out of line in relation to and independent of each other, thereby allowing a much easier movement when going round curves and into loops, which not only means a great reduction of current consumption, but also a considerable saving in wheel tyre wear and also adds not a little to the comfort of the passengers.

To the springing of this truck special attention has been given and considerable improvements have been effected which will give a much better riding car. The axlebox springs have been transferred from the top of the axlebox and supported on either side of the frame yoke of the driving wheel. The motor suspension is of the Peckham flexible type to allow the motors to float with the axles, thereby considerably reducing the wear of the bearings and equipment generally.



The Peckham "New Type" Side Bearing Maximum Traction Truck.

The brake gear is designed so that the line of application is in line with the centres of supports, and to overcome the existing troubles now experienced on this type of truck, and can be arranged to work in conjunction with magnetic track brakes.

The side frames, it will be noted, are of cast steel, and whilst being of a very light section are exceptionally strong, and are braced at the driving end with a cross-bar of H section to take the rack and twisting move-

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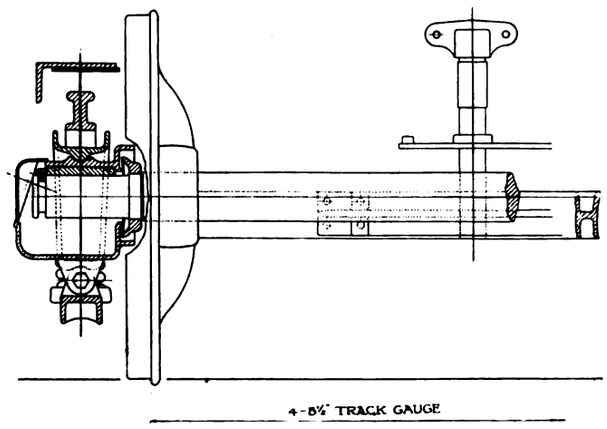
ment from the ring pin, a detail which has given considerable trouble on the existing types of trucks. This truck is considerably lighter than the swing bolster type and permits of easy access to the magnetic track brakes which are usually fitted to this type of truck. It also allows the motors to be suspended inside the truck instead of on the outside, as is the case on the swing bolster type.

The Peckham Truck and Engineering Company, Limited, are prepared to give a practical demonstration of this new type of truck and will be pleased to supply



sample sets for this purpose on reasonable terms which can be obtained on application to them.

They have asked us to mention that the pendulum gears, which are in use on so many tramways, and are giving entire satisfaction, can be applied to all makes of existing trucks.

MOTOR TOWER REPAIR WAGON LICENCES.

A CURIOUS LICENSING POINT.

A case of particular interest to tramway authorities was heard at Falkirk Sheriff Court on February 1. The Falkirk and District Tramways Company were charged at the instance of Stirling County Council with having on June 6, 1921, used a motor tower repair wagon for which a licence was not in force. Stirling County Council maintained that the duty payable on the vehicle was £25, whilst respondents contended that under the terms of the schedule attached to the Finance Act they were not bound to pay more than 5s. duty, as the vehicle came under the category of a tractor carrying only its own gear and used solely for repairs and not for commercial purposes.

Mr. D. Hays, general manager and engineer of the tramways company, admitted that the company had no licence at all for the vehicle. He also admitted that through an oversight the 5s. duty which was due had not been paid at the time. In view, however, of the fact that the County Council demanded £25 for a licence, the case was considered one of considerable importance, and pending a decision no tender was made at all. Glasgow Corporation, who possessed several vehicles similar to the one owned by the Falkirk Company, had refused to pay the higher licence.

The Procurator-Fiscal said the case seemed to depend entirely on the interpretation of the Finance Act and the Roads Act of 1920. He quoted several passages to prove that the vehicle was one for which a £25 licence should be taken out. Sheriff Robertson said the question was one for the High Court of Exchequer, and should be settled by judgment there. This was a question of general interest to the Corporation of Glasgow and to County Councils throughout the country where there were tramways, and it would be far better to have the question settled by a special case to the High Court. There was no question, however, that the respondents ought to have had a licence, and he thought a penalty of £2 2s. would meet the character of the offence.

Reductions in Tramway Employees' Wages were made at the first full pay period in February as follows—Employees aged 18 and over, 3s. per week (making a total reduction since August last of 8s.); employees under 18 years of age, 1s. 6d. per week (total reduction since August last of 4s.).

SOUTH AFRICAN RAILWAY ELECTRIFICATION.

IMPORTANT CONTRACT FOR A BRITISH FIRM.

The Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, Manchester, have been successful, we are informed, in securing the first order placed in connection with the electrification of the Union of South Africa railways. The section on which work is to be started is that from Glencoe to Maritzburg on the Natal line, and the amount of the present order will be between £750,000 and £1,000,000.

It was before the war that suggestions were first made for extensive conversion to electrical operation of the South African railways. In June, 1919, Messrs. Merz & McLellan, consulting engineers, submitted a comprehensive report covering electrification schemes for—(1) Capetown to Touws River and Capetown suburban lines; (2) Glencoe-Durban and Glencoe-Vryheid East; (3) Witbank-Germiston-Randfontein and Witbank-Komatipoort. From this report it was apparent that the most pressing case was the Glencoe-Durban section, and particularly the 120 mile Glencoe-Maritzburg, as beyond Maritzburg conditions had been made easier by extensive deviations.

Important economies will be effected by the introduction of electric locomotives. Assuming a loaded traffic of 20,000 tons per day in one direction on a 1 per cent. up grade, 11 electric trains (each of about 1,800 tons) would be capable of this duty, for which 14 steam trains would have to be employed. A valuable feature of electrification in these hilly districts will be the characteristic of regenerative braking on descending grades, obviating all the wear and tear on wheels and brake shoes inevitable with steam traction. This electrification will be one of the most important yet undertaken, comparing in this respect with the Chicago, Milwaukee and St. Paul railroad, the locomotives being designed to take a continuous current supply of energy at a pressure of 3,000 volts on the trolley line.

It is understood that at least 70 electric locomotives each equipped with four motors, will be required from the Metropolitan-Vickers Company. The construction of these, and of the necessary control gear, is expected to afford considerable employment at Sheffield and Trafford Park when the work is fully in hand. That the first order placed for this important contract has been secured by a British firm in face of keen European and American competition, is a matter for congratulation.

LONDON AND BRIGHTON RAILWAY ELECTRIFICATION.

A contract in connection with the extension of the electrification of the London, Brighton and South Coast Railway has been placed with the General Electric Co. Ltd., who will undertake the necessary manufacture at their Witton Engineering Works, Birmingham. Work will begin within the next few months, and will be completed within twelve months. It is understood that the contract, which is one of several that will probably arise out of the grouping system consequent upon last year's Railway Act, is for the provision of the whole of the electrical equipment for twelve additional motor coaches, each of 1,000 h.p., to enable the section of the line from Balham through Thornton Heath to Selhurst and West Croydon to be operated electrically. The equipment is for employment with single-phase alternating current.

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THE
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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, FEBRUARY 16, 1922.

Car Improvements. Considering the large number of new cars put into service since the close of the war disappointment may be felt that in only comparatively few towns do the bodies show improvements. The leading exception, of course, is Newcastle-on-Tyne, with its front exit and interior staircase cars. Belfast and Salford are successfully experimenting, the former with the front exit and the latter with front exit and inside staircase, as an aid to speedy working and lessened liability to passengers' accidents. Considerable advances are about to be entered upon at Edinburgh in connection with the electrification of the cable tramways. In taking the advice of their general manager to make the change, the City Council will effect an economy that cannot be properly expressed in monetary terms. One, among several, instances in which the city will gain from Mr. Pilcher's experience at Aberdeen and elsewhere is in the utilisation of existing cars, after effecting notable improvements in the bodies and fitting them with new trucks. Briefly expressed, the main requirement is governed by the fact that 25 per cent. of the traffic is at penny fares, thus rendering unnecessary bogey cars of maximum seating capacity. Experiments made by the management with each type of car have shown, as was to be expected, a saving of some 20 per cent. in power consumption for the single truck car. The large amount of short distance traffic is also a reason for effecting improved means of entering and leaving. This is to be accomplished by giving existing and new bodies a front exit. Edinburgh will thus set an example that will not be lost upon its numerous summer visitors. Another improvement will be the fitting of vestibule ends, as is the case in a number of northern towns. With the means that are now available for keeping the glass free from moisture, the enclosing of the motorman entails but little risk. The pros and cons of the vestibule will, however, shortly be made the subject of a report from a committee of the Municipal Tramways Association. One argument in its favour can be supplied by Mr. Pilcher, who has found that with the non-protected cable car most of the accidents in which drivers are involved occur during rain, exposure to which renders them less alert and more liable to make mistakes. Coming south, satisfaction may be found in the fact that the new cars now being delivered to the London County Council, besides being fitted with more powerful motors, are better lighted and ventilated. The weather-protected air outlets to the top covers are long overdue. It is to be hoped that the device will avert the need partly to open the windows in bad weather, with consequent lowering of temperature and wetting of the seats.

Economy in Tramway Operation. Alike in the affairs of the State and in municipal and private business life, economy is the most urgent need of the day. Nature for a year past has been impressing that lesson on every individual in the matter of water supply. Now the railway companies, as a matter of self-preservation, are insisting that their employees should realise the need for economising in the use of the various materials handled in their daily labour. Mr. A. J. Hill, chief locomotive engineer of the G.E.R., led off by urging firemen to use four shovel loads of coal per mile instead of five, thus saving £312,000 per annum, or more than half of the total amount spent on coal

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before the war. Almost concurrently, Mr. Felix Pole, general manager of the Great Western Railway, issued an "Economy and Co-operation" circular, in which he stated that if every employee economised in the use of stores, &c., to the extent of sixpence per week, there would be a yearly saving of over £100,000. The appeal has been met with goodwill on the part of the employees, and in the Great Western Company's Magazine Mr. Pole says that if the tenor of the communications received are an earnest of the practical interest engendered, the success of the movement is assured. Tramway managements long ago devoted anxious attention to economy, but there is no reason why their efforts should not be extended and emphasised. In the case of the London County Council tramways department, effective steps for securing economy were taken as far back as the last stage of the war. Mr. Fell, the general manager, was inspired to action at that time by the material which, for courtesy's sake, was termed "coal." What was done in those trying days in the power-house led Mr. Fell to issue a pamphlet indicating how many employees, including the car crews, could assist in economical operation. So impressed were the County Council with Mr. Fell's practical advice, that they ordered the pamphlet to be printed for circulation among the employees. Since then the management has made a most effective bid towards a great yearly saving by asking the licensing authority at Scotland Yard to allow the annual painting of the cars to take place only when equipment needs overhauling. That the request is not unreasonable is shown by provincial experience. With regard to the various ways in which tramway operation costs can be reduced with the co-operation of all ranks, it would perhaps assist the industry if managers sent to us an account of the steps they have already taken to reduce expenditure other than by wage reductions. As respects the latter, it is imperative that all waste time should be cut out. The undertakings cannot in the present conditions pay for services not rendered, and the employees will best serve their own interests by recognising the need of the employers to increase economic efficiency.

The One-Man Car in London. A noteworthy event during the past month has been the experimental running of a one-man car on the London United Tramways at Kingston-upon-Thames. The event attracted considerable attention in the press, and it is well that the advantages —so often emphasised in these pages—of cars of this and similar types should be made widely known. Though the experiment is only tentative, it is certainly a hopeful one, and tramway managers generally will be interested to hear of the results obtained. The car is by no means identical with the "Birney safety car" so widely used in America, though it forms some approximation to it. The method of its operation is, of course, similar to those of the American cars, but the vehicle itself is much heavier than is usual for one of this class, weighing unloaded about 12 tons. The motors are also heavier and larger than a one-man car usually calls for although their rating is only about 25 H.P. each. Apart from constructional details, however, the advantages which accrue from this system of operation are undoubted. The success of the one-man car throughout the United States has been remarkable. In cases where a street railway undertaking has had to encounter keen competition from other forms of transport—chiefly from the "jitney," as the private motor omnibus is called—or has suffered heavily from high operating costs, the safety car has often been the means of finding a way out of the difficulty. The causes are readily apparent. A marked economy is effected by the use of such cars during the less busy hours, when the volume of traffic does not merit the running of large, double-deck vehicles. The reduction of working expenses is accompanied by a more frequent and faster service, and what is even more desirable, accidents are practically eliminated. Mr. Spencer has studied the subject closely and it will be remembered that at the annual congress of the Tramways and Light Railways Association, held in London in 1920, he recorded his impressions of a visit to America the previous autumn. He was then much impressed with one-man operation, and noted that some car-building firms had designed "most ingenious cars," carrying from 30 to 40 passengers. These were being supplied in large quantities not only to small tramways with light

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traffic, but even for use on fairly heavy traffic routes. Though Mr. Spencer observed that the cost of operation was about half that of an ordinary heavy car, it is not to be supposed that the same ratio would apply in this country. It has been estimated, however, that platform costs can be reduced by nearly half, a factor which in itself should do much to popularise the one-man vehicle here. Fare collection constitutes a much more difficult problem in this country than across the Atlantic, where the simpler fare system facilitates matters to a great extent. The simpler the method which is decided upon, the greater will be the effectiveness of one-man operation. The difficulty is not insuperable, as is proved by the fact that Mr. Pringle, general manager of the Victoria (Australia) Electric Supply Company, was able to introduce a successful method at Ballarat and Bendigo. Apprehension is sometimes felt by managers in this country that difficulties with the operating staff may arise over the introduction of the one-man car. There is no reason why this should be so. In America, owners, the public, and the employees alike recognise the vehicle as a labour-saving medium, which by tending to make the tramway undertaking more profitable, will eventually react to the benefit of the employees as a body. The extent of staff reductions entailed by the change is far less formidable than might appear, for the general experience is that more cars are required, affording a considerably improved headway. The men can hardly fail to realise that, after all, efficient and economical service for the public must be the first consideration of any management.

The Trolley Wire in Princes Street

The Dean of York is much troubled by the prospect of overhead trolley equipment being erected in Princes Street, Edinburgh, to the detriment of the view associated with this famous thoroughfare, and has made his protest in a letter to *The Times*. He is not alone, of course, in the opinion he puts forward, for literally scores of letters have appeared in the Scottish press in favour of and against what is now the twice-affirmed decision of the Town Council. To the views of responsible spokesmen resident in Edinburgh due attention should, of course, be paid when dealing with the affairs of their own city. But the Dean of York confesses that he is "merely an occasional visitor, with a great love of Scotland and of romantic beauty." While these latter characteristics are shared by many others, they assuredly will not solve Edinburgh's pressing transport problem, nor help the citizens to get quickly to business and quickly home again. May it not be presumed that the Edinburgh Town Council and the municipal electorate are quite capable of looking after their own interests without the unsought advice of those who do not even live within their own borders? The Dean is, however, not satisfied with merely his own interference; he appeals to "lovers of beauty throughout the kingdom to save Princes Street." It is unfortunate that with the Dean's great love for Scotland he should not also have some respect for the sound judgment of the inhabitants in domestic affairs, without rallying the rest of the kingdom to their aid. There is another phrase in his letter which goes further to discountenance the Dean's status as an adviser on Edinburgh tramway matters. "I hope I am mistaken, but it is commonly reported," his letter opens, "that the Edinburgh city authorities contemplate," etc., and he proceeds to refer to the conversion of the tramways to electric traction. So that the Dean has apparently not even read any of the numerous debates and official reports which have now firmly convinced the Town Council that the overhead system for Princes Street would best serve the interests of Edinburgh. If this represents the degree of acquaintance on which the Dean bases his views on local government, then it were well that the Edinburgh authorities keep their own counsel—as we are sure they will.

PASSING STATIONARY TRAMCARS.

PROPOSED NEW BY-LAW AT ABERDEEN.

Definite steps have now been taken at Aberdeen with the object of reducing the danger arising from vehicles passing on the near side of stationary tramway cars. Councillor Wright, who has taken a leading part in the agitation for a new by-law, was invited to a meeting of magistrates, on January 31, to consider the framing of a new by-law under the Corporation Tramways Act, 1908. A resolution was carried to the effect that by-laws should be passed requiring all vehicles, including cycles and motor cycles, to move at a dead slow pace when passing a stationary tramcar while passengers were leaving or boarding.

Commenting on this decision, the *Aberdeen Daily Journal* refers to it as "a compromise which is not regarded as satisfactory by those who have been taking an interest in Councillor Wright's efforts to safeguard the public who use the tramcars. The Councillor's proposal was that a by-law similar to that adopted in Glasgow should be introduced in Aberdeen, compelling motor cars and other vehicles coming behind a tramcar standing at a stopping-place, to come to a dead stop. The magistrate's compromise, allowing vehicles to go through groups of tramway passengers, leaving or boarding tramcars, at a walking pace, is regarded by Councillor Wright as an aggravation of the evil. . . . His contention is that under the proposed by-law there is no protection for the tramway passengers, as now, when an accident occurs, the driver of the vehicle will plead that he was passing the stationary tramcar at a walking pace, and, therefore, conforming to the by-law.

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CORRESPONDENCE.

RAIL CORRUGATION.

A SUGGESTED EXPLANATION.

To the Editor of "THE TRAMWAY AND RAILWAY WORLD."

Sir,—When I received the proceedings of the Municipal Tramways Association and saw that sub-committee No. 1 of the Municipal Tramways Association had presented their final report on Corrugation, I hastened to turn to it with the full assurance that at long last I should find that the troubles of the tramways engineer were at an end, or at least alleviated. But alas! what did I find? I found what one is almost tempted to describe as an academic treatise by a learned professor on certain experiments carried out with meticulous exactitude in his laboratory.

It must be said, however, that apparently the terms of reference of this sub-committee were limited to "the analysis and investigation of the question of vibration of rails and foundations." But even so, I cannot see that the conclusions arrived at help the tramways engineer in the slightest degree—nor advance the solution of the question one iota. Here we have the experiment carried out under conditions that are entirely foreign to the practical every-day operation of tramways. The rail "is always dry and only slightly dusty," "maximum traction bogie trucks" only were used, and these of "42 H.P." The rail is supported "by fixing wide bulb angle iron to both sides by bolts every 12 inches," and conduit construction only is experimented with, and with single-deck cars.

How many tramways have all or even any of these conditions?

The conclusions arrived at by the sub-committee in 1914, which are apparently now confirmed, throw no practical light upon the question, and add hardly anything to what has been known for many years. Take, for instance, conclusion No. 8. "That corrugation is removed at and near stopping-places by magnetic brakes!"

The final conclusion arrived at is "That corrugation is inseparable from the action of the heavily loaded wheels rolling along the surface of the tread of rails, and that this rolling originates the corrugation, etc., etc.

Then why are not all rails corrugated? What is the explanation of the fact that frequently—one might even say generally—the corrugation only appears on isolated portions of track, for perhaps one or two rail lengths only, and even then not on opposite rails?

Now the more I look into this question the more I am convinced that the root of the trouble is inherent in the rail itself, and in this connection I would like to remind you that in 1906, nearly 16 years ago, I put forward a theory which appeared in the form of letters to the *Electrical Review*, and which I brought to the attention of the then hon. secretary of the Municipal Tramways Association in 1909. I have not been able further to investigate this theory, but it is an interesting one, and perhaps you would find space to reprint the letters to the *Electrical Review* of November 6 and 19, 1906.

Incidentally I may add that Mr. A. L. C. Fell, in his able and comprehensive paper to the sixth conference of the Municipal Tramways Association of 1907, supported my theory in a very marked degree, when he said "he still considered that the 'original sin' is produced when the rails are rolled."

Yours faithfully,

L. E. HARVEY,
Tramways Manager and Engineer.

Ilford Urban District Council,
Tramways Department,
Ley Street, Ilford, Essex, February 1, 1922

The letters referred to above are as follows—

I have just come across a short length of rail about 12 ft. long which shows some remarkably well defined vertical corrugations or buckles in its web. They are very regular, and their depth is about 3-16 in. and pitch 2½ in. This rail has never been laid in the ground, but was part of a stack left over when the system was first laid down.

It appears to me that this may be a very exaggerated case of what occurs in a great many rails in a much less degree (in a degree, in fact, which is too small to be obesrved with the eye or touch, but which is nevertheless there), and if there is such a state of things in the web of the rail, surely it would in course of time make itself evident on the head of the rail which it directly supports, and the larger the buckle in the web the sooner the corrugations in the tread will appear.

I said that the pitch of this buckling was 2½ in., and perfectly regular. Now, our corrugations here are of this pitch, and I believe this is a very general measurement throughout the country; surely then it is something more than a coincidence that the pitch of the buckle should be exactly of the same dimensions as the pitch of the corrugation.

Now, as to the cause of this buckling or corrugation of the web of the rail, my idea is that it is caused by contraction owing to the particular rail leaving the rolls at too high a temperature, and the mass of the head and the foot together being much greater than the mass of the web. The latter is the weakest part of the section, and is the one which has to give way; and I further suggest that the "2½ in." bears some relation to the ratio of area of head plus area of foot in proportion to the area of web, which may account for the regularity of the effects.

Of course only a certain proportion of rails would leave the rolls at too high a temperature, and this would account for the promiscuous occurrence of corrugation, or, perhaps, it may be that rails rolled in intensely cold weather, though they leave the rolls at the usual temperature, may cool off quicker, and thus cause the buckling.

Since writing the above, I have examined some more rails in the same stack, and found further instances of the buckling, some of them so small that I could only just detect them by touch and not at all by eye. Moreover, on rails of different manufacture from the others, namely, on Dicker patent rails, I still detected the same effect.

(Signed) LIONEL E. HARVEY.

Sunderland, November 6, 1906.

With reference to my letter which appeared in your last issue, it has been brought to my notice that there is some doubt as to the position of the buckling or corrugation which I observed in the web of the rail. What I meant by a "vertical buckle" was such a one that, supposing the head of a rail to be removed, an observer looking down upon the rail as it lay upon the ground would see the web as a wavy strip having its maxima or minima 2½ in. apart.

Upon looking over an article which appeared in a contemporary by Mr. John Hart, of Middlesbrough, although I do not agree with his theory, I see that, incidentally, he supports mine of the cause of buckling in the web, for he says that a rail usually contracts more in the head than the flange, and therefore I take it more also than the web.

Again, I suggested that the "2½ in." was, perhaps, a function of the ratio of the area of the sections of the head and of the foot to the area of the section of the web. Upon measuring, roughly, such area of a section of 96 lb. rail, and taking only the thick portion of the foot which adjoins the bottom of the web, and excluding the thin extremities of the foot, I find that the ratio does approximate to 2½. I excluded the thin extremities of the foot because it is apparent that these cool off very quickly.

I may say also that it is very probable that the buckle in the web causes segregation at every wave, for unequal stresses must be set up at each wave, and would thus cause regular segregation by purely mechanical means, apart altogether from the question of bad mixing of the molten steel.

(Signed) LIONEL E. HARVEY.

Sunderland, November 19, 1906.

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T.O.T. PHILHARMONIC SOCIETY.

SUCCESSFUL PRODUCTION BY DRAMATIC SECTION.

The dramatic and operatic section of the T.O.T. Philharmonic Society (composed almost exclusively of employees of the London Underground group of companies) gave an excellent performance of Edward German's comic opera, "Tom Jones," in the King's Hall, Covent Garden, on February 8 and 9. This was the third performance by the dramatic section, which at present numbers about 60 members. There was a large audience on both evenings, including several directors of the T.O.T. companies and representatives of other systems.

As in the case of previous performances, the opera was produced under the personal direction of Mr. Emil Hardy, who did his work very thoroughly, though with quite a small number of rehearsals. The settings were highly artistic, and Mr. Hardy succeeded in infusing his caste with an abundance of merriment. Most of the singing was pleasingly tuneful, and the *tout ensemble* was admirable. The show was also beautifully dressed. The dances were skilfully arranged and adapted to the music by Miss Norah Webber, while the direction of the all-important musical side was in the capable hands of Mr. Ewart Beech, who attended to the choral work, and to Mr. C. F. Lambert, who was responsible for the training of the orchestra. Especial praise is due to the orchestra—now about 40 strong—who are all amateurs, and mostly drawn from the vehicle operating staffs. This is one of the few amateur orchestras in London which are independent of professional assistance for their public performances, and it may be said to their own and Mr. Lambert's credit that they displayed marked capability. A noteworthy feature was the playing, as an overture, of the grand march, "Florenzo," which was composed and conducted by Mr. E. J. Jordan, an omnibus conductor attached to Dalston garage.

Of the caste, much could be written in their praise, for several of the members showed far more than the average ability of amateurs. With the general level of achievement so high, however, it would be invidious to particularise, though tribute should be paid to the work of the following—Mr. John Woodington (Tom Jones), Miss Queenie Thomas (Sophia), Mr. Cyril Corker (Benjamin Partridge), Miss Hilary Pay (Honor), Mr. H. A. Walker (Gregory), Mr. G. J. Nicoll (Squire Western), Miss Tilly Mitchell (Lady Bellaston), Miss Pat Morrison (Miss Western), Mr. S. Murlis (Mr. Allworthy), and Mr. E. F. Woodward (Blifil).

Speaking from the stalls at the close of the second evening's performance, Mr. H. E. Blain, C.B.E. (assistant managing director of the Underground Group), expressed on behalf of the audience their warm appreciation of the performance. He was sure the company must have known from the frequent applause how much their efforts had been welcomed. This was only the third work produced by the dramatic section of their society, and he thought he was justified in emphasising how great was the artistic success they had attained. It would be unfair to single out for individual praise any member of the caste. All had commended themselves to the audience—the men had been manly and the women had been both graceful and beautiful.

Mr. Blain proceeded to refer to the self-sacrifice and labour which such a production entailed. He would say to Mr. Lambert how greatly the orchestra had improved, and also congratulated Mr. Hardy on his "production." To Mr. Beech he pointed out that the *tout ensemble* was excellent, and concluded by a graceful reference to Mr. J. P. Thomas and his committee for the work they had done. "May the society live long, and always bring the pleasure it has done to-night," Mr. Blain added, and the audience acquiesced with cheers.

Among those present at the final performance were the following directors and officers of the Underground and associated companies—Sir James Devonshire, K.B.E.; Mr. H. E. Blain, C.B.E.; Mr. C. J. Cater Scott, Mr. H. A. Vernet, Mr. G. J. Shave, Mr. C. J. Spencer, Mr. J. P. Thomas, Mr. S. J. Webb, Mr. C. Leese, Mr. W. S. Every, and Mr. W. Rushton.

EAST LONDON RAILWAY.

A reference to the possible grouping of the London railways was made by Lord Claud Hamilton at the annual meeting of the East London Railway Company at the Great Eastern Hotel, E.C., on January 31. He said that under the Railways Act 1921, the railways in the metropolitan area had been left to take their own course. So far they had considered no scheme of general amalgamation, but he believed it would be in their own interests, and especially in the interests of the public, that they should form one group, which, of course, would include the East London Railway. Unfortunately, the East London was not a free agent, and must be dependent on the final destination of the six lessee companies.

LONDON UNDERGROUND RAILWAY DIVIDENDS.

METROPOLITAN DISTRICT.—Dividend on the ordinary for 1921 of 1 per cent.; £65,000 to reserve, leaving £60,550 to be carried forward. The dividend on the ordinary shares is the first paid since 1882, when the distribution was at the rate of $\frac{3}{16}$ per cent.

LONDON ELECTRIC.—Final dividend on the ordinary of 1¼ per cent., making 3¼ per cent. for the year; £65,000 to reserve, leaving £39,700 to be carried forward.

CITY AND SOUTH LONDON.—Final dividend on the ordinary of 1¼ per cent., making 3¼ per cent. for the year; £36,000 to be placed to reserve (an addition of £11,000 compared with the previous year), leaving £25,000 to be carried forward.

CENTRAL LONDON.—Final dividend on the ordinary stock of 2 per cent., making 4 per cent. for the year. Final dividend on the preferred ordinary stock of 2 per cent., making 4 per cent. for the year. Dividend for the year on the deferred ordinary stock of 4 per cent.; £29,000 to reserve (an addition of £9,000 compared with the previous year), leaving £59,600 to be carried forward.

LONDON GENERAL OMNIBUS.—Final dividend on ordinary of 3½ per cent., free of income tax, making 8 per cent., free of income tax, for the year; £335,000 to be placed to reserve, leaving £67,900 to be carried forward.

ASSOCIATED EQUIPMENT COMPANY.—Trading results for the year do not justify the payment of a dividend on the ordinary shares.

UNDERGROUND ELECTRIC RAILWAYS OF LONDON.—Full interest on six per cent. first cumulative income debenture stock, and 2 per cent., free of income tax, on six per cent. income bonds of 1948 for the half year, with a carry-forward of £26,600.

SOUTH METROPOLITAN TRAMWAYS.—The South Metropolitan Electric Tramways and Lighting Company recommend a dividend on the ordinary shares for the year of 7½ per cent., placing £15,000 to reserve for reconstruction and renewals (an addition of £4,500 compared with previous year), leaving £2,864 to be carried forward, compared with £1,556 brought in.

LONDON AND SUBURBAN TRACTION.—Subject to confirmation in general meetings of the respective dividend announcements by the various companies in which it is interested, and subject to final audit of accounts, the revenue of the London and Suburban Traction Company will enable it to pay 3½ per cent. in respect of arrears on its five per cent. cumulative preference shares, with a carry-forward of £11,523, compared with £1,205 brought in.

METROPOLITAN ELECTRIC TRAMWAYS.—The Metropolitan Electric Tramways recommend a dividend of 7 per cent. on the five per cent. cumulative preference shares, being balance of 4½ per cent. for the year ended December 31, 1919, and 2½ per cent. on account of year ended December 31, 1920, placing £67,500 to reserve for reconstruction and renewals (an addition of £57,500 compared with previous year), leaving £2,420 to be carried forward, compared with £1,538 brought in.

METROPOLITAN RAILWAY.

FINAL DIVIDEND IMPROVED.

The directors of the Metropolitan Railway Company announced on February 3 that, subject to final audit, they recommended a dividend on the ordinary stock for the past half-year at the rate of 3¼ per cent. per annum, making 2¼ per cent. for the year, carrying forward about £17,000 after placing £50,000 to the renewals fund.

The dividend for the corresponding half-year in 1920 was at the rate of 2 per cent. per annum, making 1½ per cent. for the year, when £50,000 was placed to general renewals fund and £15,416 carried forward. The distribution on the Surplus Lands Stock for the past half-year will be at the rate of 3 per cent. per annum, carrying forward about £1,320. The dividend for the corresponding half-year in 1920 was at the rate of 3 per cent. per annum, when £1,000 was placed to reserve and £1,940 carried forward.

LONDON AND BRIGHTON RAILWAY.

FINAL DIVIDENDS DECLARED.

The directors of the London, Brighton and South Coast Railway announced on February 2 that the accounts for the year ended December 31, 1921, subject to the completion of the audit, show a balance which will enable the following dividends to be paid on the ordinary stocks—£4 5s. per cent. for the half-year on the undivided ordinary stock, making, with £1 per cent. already paid, £5 5s. per cent. for the year, the same as for 1920; £4 per cent. for the half-year on the preferred ordinary stock, making, with the £2 per cent. already paid, the maximum dividend of 6 per cent. for the year 1921; and £4 10s. per cent. for the whole year 1921 on the deferred ordinary stock, as compared with £4 10s. per cent. paid for the year 1920, leaving a balance of about £35,671 to be carried forward, as compared with £35,512 brought in.

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FINANCIAL REPORTS AND MEETINGS.

THE EDISON SWAN ELECTRIC COMPANY, LIMITED, has passed the dividend on the preference shares for the half-year to January 31.

J. BROCKHOUSE AND COMPANY, LIMITED, have paid an interim dividend of 5 per cent. (1s. per share), free of tax, on the ordinary shares.

FIFE TRAMWAY, LIGHT AND POWER COMPANY.—The issue of £250,000 7 per cent. debenture stock at 93 was largely over-subscribed, and the list was closed the day after the prospectus appeared.

ALLEN-LIVERSIDGE, LIMITED.—A final dividend has been declared at the rate of 10 per cent., less income-tax, for the six months ended October 31, 1921, making, with the interim dividend paid, 10 per cent. for the year.

LANARKSHIRE TRAMWAYS COMPANY, LIMITED.—The directors decided to recommend a dividend of 6½ per cent. for the past half-year, making, with the interim dividend of 5 per cent. paid to June 30, a dividend of 5¾ per cent. for the year.

CITY OF BUENOS AIRES TRAMWAYS COMPANY (1904).—A balance dividend of 1s. 3d. per share, making 5 per cent., less tax, for the year 1921, has been declared; £2,000 has been transferred to general amortisation fund (against £3,000 last year), and £7,339 is carried forward, against £3,940 brought in.

NEW SOUTH WALES TRAMWAYS.—The report of the Railway Commissioners for New South Wales on the working of the railways and tramways for the quarter ended September 30 last gives the following figures in respect of the tramways—Revenue, £860,142, an increase of £101,203; expenditure, £706,336, an increase of £82,517; percentage of expenditure to earnings, 82·12, an increase of 0·08.

ANGLO-ARGENTINE TRAMWAYS COMPANY.—The results of the working for the year 1921, as cabled from Buenos Aires, will permit of the payment of a half-year's dividend on the 5½ per cent. cumulative second preference shares. This payment, amounting to 2s. 9d. per share, less income-tax at 6s. in the £, will satisfy the arrears to June 30 1917, and will be made to shareholders on the books of the company at February 7, 1922.

HULL TRAMWAYS ESTIMATES.—Mr. E. S. Rayner, general manager of Hull Corporation Tramways, estimates that the undertaking will show a surplus of £554 at the end of the current financial year, in spite of a decrease in revenue of £25,602. He also expects a deficit on the Stoneferry omnibus service (which has been running for six months) of £413. Mr. Rayner estimates that the result of the coming year's operation of the tramways will be a surplus of £11,800.

HONG-KONG TRAMWAY COMPANY have announced that they propose to assign the whole of the undertaking to a new company, to be incorporated under the Hong-Kong Companies' Ordinance, in exchange for shares of that company. The capital of the new company will be 325,000 shares of the nominal value of 5 dollars each, treated as fully paid up. All these shares will be issued to this company. The Board are convinced that this act is in the best interests of the company, to reduce the future liability of the company for Corporation profits tax, and to a great extent eliminate the differences in exchange which occur each year.

CHATHAM AND DISTRICT LIGHT RAILWAYS COMPANY.—The report for the year ended December 31, 1921, states that the revenue for the past year shows a decrease of £3,446, and the expenditure a decline of £1,228, as compared with 1920. The falling-off in net revenue is due to the coal stoppage and trade depression. The sum of £4,000 (against £6,000 last year) is placed to depreciation reserve, and a balance dividend at the rate of 4 per cent. per annum is recommended on the ordinary shares, making 4 per cent. for the year 1921, against 5 per cent. for 1920, £598 being carried forward, compared with £1,608 brought in. Traffic receipts amounted to £86,659, as against £90,080 last year, while the passengers decreased from 16,179,858 to 14,804,378. The car mileage was 974,706, and the company operates 50 cars.

DOUGLAS SOUTHERN ELECTRIC TRAMWAYS, LIMITED.—The annual report states that the season was a comparatively short one owing to the miners' strike, with the consequent loss of Whit-week and practically the whole of June traffic. There was a decrease in the total receipts (less tolls) of £3,700. The net profit was £2,425 (a decrease of £3,599), to which is added £1,568 brought forward from last year, giving an available total of £3,994. The directors recommend a 7 per cent. dividend on preference shares, less income-tax, and a 5 per cent. dividend on the ordinary shares, less income-tax, and that the balance of £1,402 be carried forward. (A reference to the proposed sale of the undertaking will be found in another column.)

ISLE OF THANET ELECTRIC TRAMWAYS AND LIGHTING COMPANY, LIMITED.—The report for the year ended September 30 last shows that the balance of profit compared with the previous year is £696 lower, at £31,448, but the total receipts amount to £105,628, against £97,244. Traffic receipts show a slight increase at £75,481, and £28,598 has been derived from the sale of electricity, compared with £22,626 for 1919-20. Allocations to the various reserve funds total £16,078, against £20,000, while the amount written off the cost of motor vehicles is £352 greater, at £864, than that so applied in the previous year. A half-year's dividend, due in July 1908, was paid on the preference shares in November last, leaving a considerable amount still in arrear. Allowing for this distribution, the amount carried forward is £3,972, against £4,284. The directors have declared a dividend on the preference shares of 2s. 6d. per share, less income-tax.

DUBLIN UNITED TRAMWAYS COMPANY, LIMITED.—The directors recommend a dividend at the rate of 6 per cent. per annum, less income tax, on the preference stock for the half-year ended December 31, and a final dividend at the rate of 7 per cent., less income tax, making 5 per cent. for the year, on the ordinary stock for the same half-year, setting aside £35,000 towards the renewal of track. The dividends and sum set aside for renewal will absorb £83,300, leaving £12,478 to be carried to the next account. The traffic receipts amounted to £675,410, an increase of £74,063, as compared with the previous year. Other receipts amounted to £20,316, the total receipts being £695,726. The number of passengers carried aggregated 7,249,897, or an increase of 1,165,121. The lines worked by the company are the same as a year ago, viz., 54 miles 15·25 chains, and the company has 326 cars. The totalk W.H. generated was 13,766,026.

PROVINCIAL TRAMWAYS COMPANY, LIMITED.—For the year to September 30 last the net revenue received from the local companies was £20,901, against £40,016 last year, to which is added amount brought in, £3,008; transfer fees and interest, £504; income-tax deducted from dividend warrants, £5,982; total, £30,395. Deducting administration and other expenses and charges, there is a balance of £2,675. In the circumstances the directors regret they are unable to advise declaration of a dividend on ordinary shares. During the year £12,455 was paid to the Commissioners of the Inland Revenue in respect of the claim for excess profits duty for 1918. The Grimsby Corporation Bill (to acquire the company's interest in the lease, expiring July 20, 1922, of the section of the Great Grimsby Tramways Company, Limited, within the borough boundaries) has been passed, and the Corporation has given notice of its intention to take over such tramways. The amount to be paid to the company will be settled by arbitration failing agreement between the respective parties. Negotiations with the Plymouth Corporation for the taking over of the company's line within the municipal area on the expiration of the lease on June 30, 1922, are still proceeding. The Cardiff Corporation has given notice of its intention to take over the omnibuses and depots belonging to Cardiff Tramways Company, Limited. Negotiations as to the amount to be paid to the company are proceeding.

LONDON UNITED TRAMWAYS.

PURCHASE OF HAMMERSMITH LINES BY LONDON COUNTY COUNCIL.

At the meeting of London County Council on January 31 it was reported that under an agreement of December 6, 1917, with the London United Tramways, Limited, the Council has to complete the purchase of that portion of the company's undertaking in Hammersmith on or before twelve months from the termination of the war, or at such earlier date within that period of twelve months as the Council may, on giving the company not less than three months' previous notice, require. The chief provisions of the agreement are as follows—

(i.) Payment by the Council of the purchase money of £235,000 in respect of the Company's lines in Hammersmith, the Chiswick power-station, depot, and certain fixed plant, furniture, implements, etc., and a sum of £1,000 deposited with the Hammersmith Metropolitan Borough Council, and 45 cars.

(ii.) The company to be at liberty to convert a part of the generating station into a transforming station, and to use the same for a period not exceeding 21 years, the company providing free of cost during that period a sufficient supply of direct current for the tramways up to 1,800,000 units a year, the Council paying for any excess at a rate to be agreed or determined by arbitration.

(iii.) If the Council gives the company notice at the same time as it gives notice requiring completion, the Council may require the company to work the lines purchased exclusively for such time and on such terms and conditions as the parties agree, the company handing over to the Council gross receipts less working expenses, and a reasonable sum for establishment charges, and the Council lending the company the 45 cars.

(iv.) If the company are not required to work the lines purchased exclusively, the Council is at liberty to run over the company's lines in Middlesex jointly with the company, and the company are at liberty to run over the lines purchased jointly with the Council, the mileage being equal, and each party accounting for gross receipts taken, the other terms and conditions being agreed or determined by arbitration.

(v.) Each party to have the right to fix and alter fares on its own tramways.

(vi.) The company to be allowed access to the transforming station, and the Council to be allowed access to the depot.

The Highways Committee recommended that the purchase should be completed on May 2, 1922, and that the company should be given notice accordingly. As payment will not be made until the next financial year, it is proposed to make provision for it in the capital estimates of 1922-23. This course was adopted.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

PASSING STATIONARY CARS—COMPETITION FROM RAILWAYS.

The magistrates, who have been considering the danger caused by vehicles passing on the near side of stationary tramcars, have given instructions that a by-law be framed requiring drivers of such vehicles to proceed at walking pace on such occasions. It is also proposed, in order still further to reduce risks, that certain tramcar stopping-places be rearranged, leaving a clearance for other traffic. The committee of the Town Council responsible for the promotion of a Provisional Order which includes clauses relating to tramway extensions have considered the effect upon the city of the railway companies' proposals to operate road motor services. As it is felt that these would compete unfairly with those of the Corporation, the latter is to oppose such clause in any Bill which the railways promote.

BELFAST.

SUGGESTED FARE REDUCTION—EMPLOYEES' HOLIDAYS.

The chairman of the Tramways Committee (Councillor W. G. Turner), replying to a deputation from the Belfast Anti-Profiteering Committee, who pressed the committee for a reduction of fares, pointed out that the tramways lost £39,000 last year, and therefore they could hold out no immediate prospect of a reduction. They would, however, undertake to reduce fares at the earliest possible moment. At a subsequent meeting of the Tramways Committee an application for extended holidays for the motormen and conductors on account of the arduous and nerve-wrecking duties they have had to perform during the past 12 months was considered. A deputation was received, and the committee decided to grant 12 instead of eight days' holiday.

BIRMINGHAM.

REVERSION TO PENNY FARES.

Penny fares were introduced on the Corporation tramways on February 6. No alterations were made in the stages and fares hitherto in force, but each route is divided up into a number of penny stages, in a few cases overlapping.

BLACKBURN.

RESULT OF THE TRAMWAY POLL.

The poll of the ratepayers on the question whether a clause should be included in the Corporation Parliamentary Bill providing for tramway extensions and the inauguration of omnibus services resulted as follows—For the proposal, 2,354; against, 8,639; majority against, 6,285. Only 20 per cent. of the electorate voted. The clause in dispute, as stated in our issue of January 21, would have involved an expenditure of £268,000. It was inserted in consequence of the report prepared for the Corporation by Mr. A. R. Fearnley (general manager of Sheffield Corporation tramways), which was summarised in our issue of December 17 last. The clause will now, of course, be dropped.

BLACK COUNTRY.

JOINT TRAMWAYS BILL.

Among the Bills which have been deposited for introduction in the next Parliamentary session is one promoted jointly by the Birmingham District Power and Traction Company, Dudley, Stourbridge and District Electric Traction Company, South Staffordshire Tramways Company, South Staffordshire Tramways (Lessee) Company, and the Wolverhampton District Tramways. The large system of tramways in the Black Country which these five companies own or lease are situated within the districts of a large number of local authorities, who are authorised to purchase compulsorily portions of the undertakings at various dates from 1922 to 1938, and at recurring intervals of seven years. The Bill now proposes to synchronise these dates and to postpone the first date of possible purchase by any one authority to within six months after September 29, 1950. From the passing of this Bill there would be incorporated "The Birmingham and Midland Tramways Joint Committee," for the purpose of managing the undertakings of the five companies.

BRADFORD.

TRAMWAY RECONSTRUCTION.

The tramway track renewals which the Corporation hope to carry out in the next 12 months, if the necessary borrowing powers are obtained, will cost about £120,000. It is proposed to rearrange the termini in Forster Square by altering the "island" at the Post Office side of the Square and encircling it with a line of track. This would connect with the Manningham Lane, Church Bank and Bolton Road routes and passengers' barriers would be constructed on the "island," eliminating the present pavement queues. When the existing track in Huddersfield Road, between Odsal Top and Hill Top, Low Moor, is relaid, it is intended that the sleeper system shall be adopted. The Corporation are laying about three and a half miles of double track on sleepers. It is estimated that the cost of the work will be only about 50 per cent. of that of tramway track laid in the usual way, while the maintenance expenses will also be considerably lower owing to the greater resiliency of the rail supports.

BRISTOL.

RATEPAYERS DEFEAT TRAMWAY SCHEME.

By means of a poll on January 31 the ratepayers decided against the proposed tramways along the Low Level Road to Avonmouth. The voting was as follows—For the Bill, 13,241; against, 19,756; majority against, 6,515. The clause which was to have been inserted in the Corporation Bill sought to authorise the provision of tramways along Avonmouth Road, Richmond Road and Terrace, St. Andrew's Road, and Gloucester Road, Avonmouth, as an extension of the tramroad already authorised to be provided on the Avonmouth Low Level Road. Further alternative powers were sought to provide railless traction in the above-mentioned roads instead of the authorised tramroad and the proposed tramways. At a previous statutory meeting of ratepayers, a resolution approving the clause relating to new tramways had been defeated by a large majority.

BURNLEY.

NEW CARS—"REVERSED" STAIRS.

Some of the five new cars ordered by the Corporation Tramways for the Manchester Road system have now been delivered. The cost of each car is stated to be about £4,000. The Ministry of Transport has informed the Corporation that the Ministry has decided not to approve the construction of the "reversed" type of staircase in double-decked tramcars in future. The chairman of the Tramways Committee, vice-chairman, and the general manager were authorised to interview the Ministry of Transport on the matter.

DUBLIN.

SETTLEMENT OF TRAMWAY DISPUTE.

By a majority of 108 (568 against 460) the employees of the Dublin United Tramways Company accepted the company's offer in respect of wages adjustment, and a threatened strike was thus averted. The employees had previously decided by 1,073 votes to 22 to strike against a proposed reduction of 5s. a week and the refusal of the inspectors to become members of the Tramway and Vehicle Workers' Union. Action was deferred, however, pending the result of a conference which took place under the auspices of the Labour Ministry, Dail Eireann, between representatives of the Company and the men's union.

EDINBURGH.

CENTRE POLES FOR PRINCES STREET—LOST FARES.

At a meeting of the Town Council on January 5, Mr. Malcolm Stuart moved that the resolution to have span wires in Princes Street, passed by the Council on December 29, be rescinded. He contended that the Council had consented to this form of overhead equipment on a snatch vote. The citizens generally could not help following in this case the advice of the tramway manager that centre poles would be much less objectionable. Mr. Douglas Elliott seconded and the motion of disapproval was carried by 37 votes to 22. Notice of motion was given to approach the Ministry of Transport for permission to erect centre poles. The decision in favour of centre poles was re-affirmed by the Council on February 2. The Tramways Committee decided to proceed with the electrification of certain sections of route No. 3, Princes Street, Gorgie, Braid Hills, Craiglockhart and Murrayfield, and remitted to a special meeting of the committee the question of the electrification of the northern routes in order that as early as possible the motor omnibuses may be withdrawn. Councillor Mancor (convener of the Tramways Committee), addressing a meeting under the auspices of the local merchants' associations, on January 17, said they had heard a great deal lately about cheap fares. Various tramway authorities had made numerous efforts to calculate some average of what was lost per car-mile through uncollected fares, resulting from a mixture of designs and carelessness on the part of both the public and the conductors, but so far no reliable figures could be given. He felt quite safe and well within the mark when he said that 2d. per car-mile was a very modest estimate. That on the Edinburgh system meant £50,000 per annum. The citizens might endeavour to assist the conductors in trying periods by not forgetting to pay their fares, and assisting as far as lay in their power to see that others did the same. The calculation quoted by Mr. Mancor aroused a good deal of local criticism.

GLASGOW.

THE PAISLEY PROBLEM—COATBRIDGE SYSTEM TAKEN OVER—CONDUCTOR'S DUTY.

The Town Council on January 5 again discussed the proposed purchase of the undertaking of the Paisley District Tramways Company. Mr. Miller opposed the acquisition of the system, which he alleged was in a most unsatisfactory state. Instead of Glasgow paying £200,000 or £250,000 it would probably be found that it

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would take £750,000 to put the system into that condition which would coincide with the city tramways. Mr. T. A. Kerr seconded. Treasurer Kelly moved that the matter should be further discussed by the Tramways Committee. He defended the proposal, and said the running of tramways beyond the municipal area had been profitable to Glasgow. The question of acquiring this system was just a question of price. He admitted the Paisley company had not been a success, and personally he would like to get from Mr. Dalrymple some more definite information as to how the system was to be made to pay. Bailie M'Whirr (convener of the Tramways Committee) supported Treasurer Kelly's amendment, and Bailie Dollan strongly urged the acquisition of the system. It was decided to remit the question to the Tramways Committee. The Coatbridge and Airdrie Tramways, which were recently purchased by the Corporation for £82,250, were taken over by the latter early in January. It is proposed to link up the Coatbridge track with the Glasgow tramways by extending the line which at present ends at Baillieston. On January 11, a lady was awarded £10 damages in consequence of her costume having been damaged in a Corporation tramcar through a button catching in a gap between the spars of the seating. The Corporation denied liability. Evidence showed that the gap was due to the fact that the seat, which also forms the lid of a storage box, had not been pushed into its place, thus leaving a space between the spars of the lid and those of the back. The Sheriff held that it was the duty of a conductor on taking over a car to inspect it with a view to the safety of his passengers, and that this duty had not been fulfilled.

HALIFAX.

PROPOSED NEW SERVICES—LUGGAGE.

The Tramways Committee have recommended the Tramways Sub-committee to consider the purchase of another motor omnibus, with a view to starting a service for Wheatley Valley. The committee also decided to recommend the Council to approve the extension of a single line from the present Skircoat Green terminus to the top of Copley Hill. The committee have resolved to charge for all passenger luggage on the cars when the weight exceeds 28 lbs.

HASTINGS.

TRAMWAY COMPANY'S APPEAL.

In the King's Bench Division, on January 23, Mr. Justice McCardie considered, in the form of a special case stated by the arbitrator, a dispute between Hastings Tramways Company and the Corporation. The action related to the construction to be put upon the word "cable" in the Act of 1920 concerning the construction of No. 1 tramway along the sea front. Counsel for the Company, who appealed against the arbitrator's decision in favour of the Corporation, said the Act threw upon the Company the obligation of connecting new lamps which they had had placed on the tramway standards with the existing main. The Corporation contended that the company must place a new lighting cable, or an addition to the existing one, and the arbitrator upheld that view. Counsel for the Corporation said it was a condition of the withdrawal of their objection to the overhead system that they were to get a new lighting system provided at the expense of the company. His Lordship found there was no statutory obligation on the company to provide a main cable, but only an inter-connecting cable, and he allowed the Company's appeal, with costs.

HUDDERSFIELD.

TRAMWAY EXTENSION TO BRIGHOUSE.

The borough treasurer has submitted a report to the Town Council which showed that the estimated cost of the permanent way for the Brighouse tramway extension was £74,000. The cost of the cars and overhead equipment was estimated at £17,500. The extension was approved subject to financial assistance being obtained from the Government.

HULL.

RELIEVING TRAFFIC CONGESTION—HESSLE ROAD ROUTE.

The City Council have now decided, in order to relieve the congestion at Midland Street corner, to divert the tramcars into Osborne Street. The scheme is estimated to cost £12,000. The Tramways Committee had recommended that the Hessle Road cars be diverted, on the outward journey down Anne Street. The City Council have decided to apply to the Ministry of Transport for an Order under the Light Railways Act, 1896, to enable them to extend the tramways to Hessle, at an estimated capital cost of £36,000.

ISLE OF MAN.

TRAMWAY TO CHANGE HANDS.

At the annual meeting of the Douglas Southern Electric Tramways, Limited, recently held at Manchester, it was reported that during the past year an agreement was entered into with the Douglas Head Marine Drive Company, Limited, by virtue of which, at the end of the concession in 1926, the Drive Company will take over the tramways as a going concern, paying therefor the agreed or arbitrated value of the company's mechanical and electrical plant and half of the value of the permanent way.

LEEDS.

THE "EXPRESS" TRAMWAY ROUTE.

It is understood that the new "express" section of the city tramways on the Roundhay route, between Harehills and Oakwood, may be completed by the end of February if the materials necessary for crossings and junction points are delivered promptly. The erection of the overhead equipment and the laying of the track on ballast and sleepers are in progress.

LONDON.

NEW ROUTE—EMBANKMENT TRAFFIC—PASSENGER'S ARREST, MAGISTRATE'S COMMENT—RAILLESS SCHEME—FARES.

On January 22 a new route of the London County Council tramways was opened between Chelsea and Southwark Bridge, via Clapham, Stockwell, Brixton and Camberwell Green. The total length of the route is nine miles, and there is a three minutes' service during the rush hours and a four minutes' service at other times. A poster just issued by the County Council tramways department states that during the business rush the number of tramcars passing along the Embankment in each direction between Westminster and Waterloo Bridges in one hour is 195, or including trailer cars, 222. It is announced that this record will be further improved as traffic requires. When an East London merchant was charged at Old Street Police Court on January 24 with riding on a County Council tramway car and refusing to pay his fare, Mr. Margetts, defending, pleaded "Not Guilty," and said it was quite a new departure to give a man into custody and keep him at the police station for such a matter. Mr. Pawlyn, representing the County Council, said they had power to detain a man under the Tramway Act or the by-laws. The case for the prosecution was that the defendant, after travelling beyond the penny stage, refused to pay the excess, saying he had got on the wrong car. The magistrate said he was satisfied that there was no intention to defraud, but it was the defendant's own fault that he was in that position. He would have to pay 30s. costs. A County Council tramcar driver was summoned at Greenwich for failing to bring his car to a standstill as soon as possible to avoid impending danger, and Mr. Pattinson, who defended, explained the driver's failure to make a statement to the police after the accident by saying that L.C.C. employees were instructed not to do so. The magistrate (Mr. Disney) said this was a most improper course, as a statement made at the time was very valuable. It was going far beyond the Council's legitimate authority. Mr. Pawlyn, for the L.C.C., said the matter had been gone into very thoroughly between the Council and the Commissioner of Police. Other considerations arose beside police-court proceedings, and there was a good deal to be said for the practice adopted. The General Purposes Committee of Lambeth Borough Council, reporting on the proposed L.C.C. railless trolley omnibus route from West Norwood to Lee Green, stated that it followed very closely that to which the Borough Council had always adhered. The committee were of opinion that the Council should offer no objection to that part of the route lying within the borough, subject to a slight modification that it should be along Chapel Road, instead of through Ernest and Rothschild Streets. It is reported that the London General Omnibus Company has formally arranged with some of the outlying tramways in the Metropolitan district not to reduce fares without consultation between themselves and the L.G.O.C.

NEWCASTLE-ON-TYNE.

LIGHT RAILWAY EXTENSION.

At the City Council meeting, Alderman R. Mayne (chairman of the Transport and Electricity Committee) moved that an application be made to the Light Railway Commissioners for authority to make a branch from the light railway to Westerhope down to Denton Burn, a distance of three-quarters of a mile, at a cost of £15,000. This will take the place of a tramway extension along the west turnpike from the Fox and Hounds down Denton Bank, a distance of a mile and a half, at a cost of £60,420. A reference to the question of the tramway employees' hours will be found on another page.

NOTTS AND DERBY.

HEANOR-ILKESTON ROUTE.

A Bill has been deposited in Parliament by the Nottinghamshire and Derbyshire Tramways Company (as mentioned in our issue of December 15) applying for powers to construct a double line of tramways and tramroads to connect its existing system, terminating at Heanor, with the Ilkeston Corporation tramways. The latter were some time ago transferred by the Coporation to the company. In order to provide a through service the gauge of the Ilkeston tramways will be altered from 3 ft. 6 in. to 4 ft. 8½ in. The capital required is to be provided by empowering the company to raise the balance of its unissued capital of £96,470 as preference capital and to borrow upon its issued capital a sum of £126,765.

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OLDHAM.

INCREASE IN PARCELS RATE.

Manchester Corporation Tramways notified the Oldham Tramways Committee that on April 3 the minimum parcels rate would be 4d. for parcels not exceeding 7 lb. in weight, and in order to make this applicable to inter-chargeable districts in the Manchester and Salford areas, they suggested Oldham should fix a minimum rate of 6d. per parcel not exceeding 10 lbs. The suggestion was approved.

PONTYPRIDD.

REDUCED FARES AND TOKENS.

The Tramways Committee decided to recommend the Council to reduce, by means of tokens, the fares of workmen by 20 per cent and those of ordinary passengers by 12½ per cent. The Rhondda Tramways Company wrote to the Council suggesting a mutual reduction of workmen's fares. In a previous report on the question of reduced fares, the engineer and manager of the Pontypridd Urban District Tramways (Mr. J. E. Teasdel) stated that he had obtained from the manager of Newport (Mon.) Corporation Tramways, replies from some 57 towns on the subject. Generally speaking, managers were of opinion that low fares for short distances is a wrong principle for small towns and that a 1d. fare to-day would have almost the same effect as that of the ½d. some years ago. Several managers pointed out that wages and costs had not decreased sufficiently to warrant 1d. fares.

SHEFFIELD.

TRAMWAY EXTENSIONS.

As part of a large scheme for relieving the unemployed, the City Council decided to extend the Ecclesall tramway route to Millhouses Lane and to double the track on the Intake route. The former scheme, which will cost £17,000, has already been started, and work on the Intake route will shortly be put in hand. The length of route to be doubled is about one mile, and at the same time the old rails will be replaced. The estimated cost of the Intake project is £31,000.

SOUTHAMPTON.

FRESH EXTENSIONS—LIGHT RAILWAY ORDER.

An extension of the Corporation tramways to Millbrook has now been opened, and it is expected that the new line from Hampton Park to Swaythling will be brought into use this month. The Minister of Transport has confirmed the Totton Hythe and Fawley Light Railway Order, 1921, authorising the construction of a light railway from Totton to Fawley in the County of Southampton.

ST. HELENS.

TRAMWAYS EFFICIENCY MEETINGS.

Some time ago Mr. L. C. F. Bellamy, general manager of the Corporation tramways, inaugurated a series of efficiency meetings, which are proving very successful. The meetings are held fortnightly in the men's billiard room, and generally conclude with a short smoking concert. The following papers have been read—"Urban Electric Traction—some phases of underground, surface and elevated systems," by L. C. F. Bellamy, general manager. "In the Grip of the Law—a review of tramway legislation," T. Kavanagh, traffic superintendent. Other papers have been read by Mr. F. L. Cokayne, chief inspector, Drivers Fred Jones (vice-president of the social and athletic club), Jackson and Taylor, and Conductor Rowland. Lively discussions followed each paper.

STOKE-ON-TRENT.

PASSING STATIONARY TRAMCARS.

In view of a recent street fatality at Fenton, Stoke-on-Trent Watch Committee have considered the advisability of establishing a by-law to compel motorists to pull up on approaching a stationary tramcar. The matter was referred to the Chief Constable's Consultative Committee.

SUNDERLAND.

STRIKE OF TRAMWAY COMPANY'S EMPLOYEES.

The employees of the Sunderland District Electric Tramways, Limited, struck work on February 2, because the company sought to make a wage reduction higher than that of 3s., which was due under the National Agreement. The company, in view of the serious decrease in revenue, contended that it is unable to continue to pay the present wage bill, and sought a maximum additional reduction of 10s. a week in the case of the higher paid men.

TAUNTON.

COUNCIL AND LOCAL TRANSPORT.

A report was published on January 28, by the Mayor, of the resumed negotiations between the Corporation and Taunton Electric Traction Company in connection with the suggested purchase of the tramway undertaking, which ceased operation last May. From this it appeared that the Special Tramways Committee of the Council disapproved of the proposed purchase and that the Council adopted their recommendation by 12 votes to seven. It is understood that the Tramway Committee's decision arose from financial considerations as the tramways had not made any return upon capital for many years. The committee recommended that steps be taken to endeavour to provide a flexible service of motor omnibuses for the borough by private enterprise. Arrangements will now be made for the removal of the tramway track and overhead equipment by the company. The roadway over a route length of nearly two miles will require to be reinstated.

TYNEMOUTH.

TRAMWAY COMPANY'S LEASE.

The Corporation Tramways Committee, after a meeting with representatives of the Tynemouth and District Electric Traction Company, resolved that the company be informed that the Corporation are prepared to enter into an agreement consenting not to exercise their option to purchase the company's undertaking for a term of 21 years, subject, however, to satisfactory arrangements being made for the Corporation to exercise their rights at intervals during such period on conditions to be agreed. The committee further resolved that the agreement should provide for an improved service and the doubling of the line at various points. Mr. H. A. Stagg (one of the company's directors) stated it was estimated that the cost of doubling the track in John Street, Cullercoats, and of that length to the north situated in the Whitley district, would be from £7,000 to £8,000.

WALLASEY.

REVERSION TO PENNY FARES.

The Borough Council have agreed to the reintroduction of penny stages, and the substitution of a discount of 2d. in the shilling on prepaid tickets, in place of the former plan of selling 13 tickets for a shilling.

YORK.

WITHDRAWAL FROM INDUSTRIAL COUNCIL.

The Corporation Electricity and Tramways Committee, who have decided to withdraw from the National Joint Industrial Council for the tramways industry, reported that they had received a letter from the secretary of the Joint Employers of the District Joint Industrial Council for Yorkshire, Lincolnshire, and North Derbyshire, asking them to reconsider their decision. The committee decided to adhere to their previous resolution of withdrawal.

MR. EDWARD HOPKINSON, M.P.

DEATH OF A PIONEER OF ELECTRIC TRACTION.

Mr. Edward Hopkinson, M.P., one of the principal pioneers of electric traction in this country, and Member of Parliament for the Clayton Division of Manchester, died on January 15, at the age of 62. Mr. Hopkinson was educated at Owens College and Emmanuel College, Cambridge, and was also a Doctor of Science of London University. At the age of 23 he became assistant to Sir William Siemens, the eminent electrical engineer, and afterwards carried out experiments at Portrush on the first electrical tramway constructed in the United Kingdom, and designed the electrical equipment of the Bessborough and Newry tramroad. He joined the firm of Mather and Platt in 1884, and took charge of their electrical engineering department. Later he became vice-chairman of the company.

Mr. Hopkinson will be especially remembered on account of his work in electrifying the City and South London Railway, which was opened in November 1890. This "tube" was the pioneer of its type, and its inauguration represented the largest application of electric power for traction purposes that had been made up to that time. Its equipment was noteworthy from the fact that separate locomotives were used, the armatures of whose motors were placed directly on the axles—an arrangement which, of course, dispensed with gearing. Mr. Hopkinson was awarded the Telford Premium and Stephenson Medal by the Institution of Civil Engineers for a paper in which he described the methods he had adopted. The firm with which he was connected also carried out the original electrical equipment of the Douglas and Laxey Electric Tramway and the Snaefell Mountain Railway (the latter having a continuous grade of 1 in 12 for over four miles), and of the Blackpool-Fleetwood tramway.

Mr. Hopkinson was a past president of the Institution of Mechanical Engineers, as well as of the Manchester Association of Engineers, and was on the Council of the Institution of Electrical Engineers.

The London Safety First Council have issued two new posters, one of which makes novel use in its design of the familiar "put and take" top. The words on each side of the top are made to open a wise injunction as to how street accidents can be avoided. The other poster bears some useful advice, well illustrated, to carmen.

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CONTRACTS AND ORDERS.

The Brush Electrical Engineering Company have an order for truck frame forgings for Glasgow Corporation Tramways.

The Electric Locomotive and Foundry Company, of Gateshead, are to supply an electric storage battery locomotive to the Glasgow Corporation.

The British Thomson-Houston Company have received an order for 114 motors and 100 controllers from the Manchester Corporation Tramways.

Halifax Tramways Committee have accepted the tender of Messrs. Vickers, Limited, Sheffield, for the supply of 72 motor pinion wheels at £1 8s. each.

Bolton Tramways Committee have accepted the tender of Hadfields, Limited, for special tramway rails, points and crossings, for the siding at the south end of the wholesale market.

Blackpool Electricity Committee have accepted, subject to the sanction of the Electricity Commissioners, the tender of Fraser and Chalmers (General Electric Company, Limited) for a 5,000-K.W. turbo-alternator.

Blackpool Corporation Tramways Committee have accepted the tender of the British Insulated and Helsby Cables, Limited, for high tension cable, and that of the Pirelli General Cable Works for low tension cable.

Rotherham Corporation have adopted the Straker-Clough trolley omnibus chassis, and an order has been placed with Clough, Smith and Company, Limited, the sole agents for this vehicle.

The Tees-side Railless Traction Board have placed a further order for four trolley omnibuses with Clough, Smith and Company, Limited. This order is the result of the successful operation of a trial vehicle recently supplied.

Clough, Smith and Company, Limited, of 36 Victoria Street, London, S.W., have secured from the Bloemfontein municipality their latest order for five trolley omnibuses, which will be of the "Straker-Clough" standard design.

Liverpool.—The following tenders have been accepted—1,000 tons of steel tramway rails, Leeds Steel Works; 30 tons of fishplates, Guest, Keen and Nettlefolds; 60 tons of steel tie-bars, Hadfields, Limited; 6 tons of steel fishplates, Horton and Son, Limited; 4,850 copper bonds, the British Insulated and Helsby Cables, Limited.

The Woods-Gilbert Rail Remodelling Company, Limited, of 170 Strand, London, W.C., have received a renewal of their contract with the London County Council for lip cutting and grooving of rails for a further period of twelve months. The company have also entered into a contract with the Exeter Corporation to remove corrugations from the rails.

Italian Railway Electrification.—It has been announced that the Director-General of the Italian State Railways is desirous of receiving tenders for the electrification of the Bologna-Venice-Monfalcon line, which is to be entrusted to private enterprise. Offers are to be received by April 30 next, and should be addressed to the Direzione-General Ferrovie dello Stato, Rome.

London County Council Stores.—The Stores and Contracts Committee of the London County Council, in their report for the three months ended December 31, 1921, mention the following—Electric lamps (14 firms invited to tender), English Electric and Siemens Supplies, Limited, estimated value, £7,250; uniform clothing for tramways department (21 firms invited to tender), John Hammond and Company, Limited, estimated value, £5,766; steel castings for tramways department (permanent way, etc.) (29 firms invited to tender), A. T. Green and Sons, Limited, estimated value, £6,060.

Salford Tramways Committee have accepted the following tenders for car accessories for three months to March 31, 1922—Cable and lamps, Power and Lighting Supplies Company, Limited; cable connectors, etc., L. Andrew and Company; armature and field coils, Barrett and Thornton; insulating varnish, Griffiths Brothers and Company (London), Limited; lamps, British Insulated and Helsby Cables, Limited; carbon brushes, J. Eades; field coils and commutator segments, Metropolitan-Vickers Electrical Company, Limited; brake blocks, National Railway and Tramway Appliances Company, Limited; trolley head slippers, British Insulated and Helsby Cables, Limited; trolley heads, G. W. Alsop; gears and pinions, British Hele-Shaw Patent Clutch Company, Limited.

New Trucks and Equipments for Edinburgh.—The Edinburgh Town Council have accepted the tender of the Peckham Truck and Engineering Company, Limited, of Audrey House, Ely Place, London, E.C.1, for 53 pendulum trucks. These trucks will be constructed for the Peckham Company by the Brush Electrical and Engineering Company, Limited, of Loughborough. The motors and truck brakes will be supplied by the Metropolitan-Vickers Electrical Company, Limited, of Trafford Park, Manchester. The order for 106 controllers required for the 53 cars has been placed with the British Thomson-Houston Company, Limited, of Rugby, while the sets of grid resistances will be furnished by the Electro-Mechanical Brake Company, Limited, of West Bromwich. The amounts of the contracts are as follows—53 tramway trucks, £9,010; 106 interpole light-weight traction motors, £18,020; 106 controllers, £5,814; 53 car sets of grid resistances, £742.

BUSINESS NOTICES.

THE ELECTRO-MECHANICAL BRAKE COMPANY have opened London offices at Donington House, Strand, London, W.C.2, with Mr. F. W. Knight as manager.

TILLING-STEVENS MOTORS LIMITED have appointed Messrs. Bristol Simplex, Limited, engineers, of Broadmead, Bristol, as their agents for Gloucestershire and a portion of Somerset.

OERLIKON, LIMITED.—We are informed that the business carried on by the British, Irish and Colonial department of the Ateliers de Construction Oerlikon has now been transferred to Oerlikon, Limited, Oswaldestre House, Norfolk Street, Strand, London, W.C. The company will represent the former company exclusively in Great Britain and the Dominions, and will sell and instal electrical machinery of all descriptions.

LEO SWAIN AND COMPANY, LIMITED, of 280 Deansgate, Manchester, are sole concessionaires for the North of England and Wales in Continental cross-ribbed cord tyres. These tyres are of special construction, each strand of the cords being embedded in rubber. This, it is claimed, reduces all possibility of friction, and consequently obviates overheating. The tyre is extremely pliable and absorbs a high percentage of road shocks, thus increasing comfort of travel.

THE RAIL AND ROAD CAR EQUIPMENT COMPANY has recently been formed by Messrs. A. V. Dismore and A. J. Smith (with offices at 205-207, City Road, London, E.C.1) both of whom have severed their connection with the late General Seating Company, Limited, for the purpose of continuing the manufacture and supply of various materials similar to those hitherto handled by that company. Among the patented articles which will be supplied by the new company are "Flex-edge" and spring cushions, "Revenu" deck chairs, "N.C." friction fittings, destination and other indicators, lettered screens and various other car fittings and accessories.

"ROAD REINFORCEMENT."—Few booklets issued from a publicity department excel in attractiveness and dignity the one bearing the above title and issued occasionally by the British Reinforced Concrete Engineering Company, of 1 Dickinson Street, Manchester. A feature of the January number is an interesting article on "The Roads of France," which includes two or three fine illustrations of famous highways flanked by the now familiar rows of trees. In an article on "Roads and Prices" the writer says that immediately good and suitable roads are provided, cheaper transport and distribution will bring down both the cost of living and the cost of manufacturing for export. Meanwhile we are losing a great deal of money for want of broad, strong, even, and durable highways.

LONDON COUNTY COUNCIL TRAMWAYS' WALL MAP.—In addition to the new pocket map and guide which the London County Council Tramways department recently issued (as noted in our issue of December 24, 1921), a large wall map of the system is now published. This measures about 33 inches by 26 inches, and forms a very complete and readily understood guide to the many routes. All the principal roads, waterways, parks, and open spaces in London and the suburbs are shown, tramway routes being indicated in red, with the appropriate service number printed at intervals over the whole length of each route. Terminal points are indicated in various colours, according to whether they apply to weekday and Sunday services, weekday services only, Sundays only, etc. Connections with other tramway systems are also shown.

MR. LIONEL ROBINSON, B.A., has taken into partnership MR. W. E. WARRILOW, A.M.I.E.E., as from January 1, and under the name of Lionel Robinson and Company, at 3, Staple Inn, London, W.C.1, they will continue and further develop the sole agency for resistance materials and wires of Henry Wiggin and Company, Limited, Birmingham, which Mr. Lionel Robinson has held for the past 15 years. Mr. Robinson is the originator, with Henry Wiggin and Company, of their well-known "Ferry" resistance wires, largely used in motor starters, controllers, regulators, rheostats, cinema projectors, and also in sliding resistances and many scientific instruments. Mr. Warrilow brings to the business 15 years' experience of commercial work, chiefly in encouraging, through the Press, the sales of electrical and allied products of every description.

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PERSONAL.

Mr. T. W. Bloxam, chief electrical engineer of Belfast, has resigned his position. Mr. Bloxam has been chief engineer since 1907.

Councillor W. G. Turner was unanimously re-elected chairman of Belfast Tramways Committee, and **Councillor D. Anderson** vice-chairman.

Sheffield Corporation Tramways and Motors Committee recommended an increase in the salary of **Mr. H. Watson,** assistant manager, from £500 to £550 per annum, but the City Council, by a small majority, withheld approval.

Mr. H. C. Day has been appointed electrical engineer and tramway manager of Heywood Corporation. Mr. Day was selected from 67 applicants. He succeeds Mr. D. H. Davies, who recently accepted the position of assistant general manager of Chesterfield Corporation Tramways.

Mr. M. B. U. Dewar, who for the past three years has been managing director of the Leeds Forge Company, Limited, has accepted the position of managing director of the Metropolitan Carriage, Wagon and Finance Company, Limited, of Saltley, Birmingham. Mr. Dewar will retain his seat on the board of the Leeds Forge Company.

Mr. F. Schofield, formerly manager of Leyton District Council Tramways (which are now worked by London County Council) has been presented with a gold watch and curb chain as a farewell gift by members of the Leyton Council and Mr. Schofield's late colleagues. Mr. Schofield now holds an appointment on the staff of the London County Council Tramways.

Alderman S. Flint has been presented with a solid silver rose bowl by past and present members of Leicester Tramways Committee in commemoration of his twenty-one years' chairmanship of the Tramways Committee. Alderman Flint was appointed chairman in 1900, and continued to hold the office until last year. His services to the Corporation and the public have been of the greatest value, and during his chairmanship the tramways were electrified and developed from a comparatively small undertaking.

Mr. William Murray.—At a well-attended social function of the Walthamstow Branch of the N.A.L.G.O., held in the Tramways Recreation Hall on January 27, Mr. William Murray (manager of the Walthamstow Council Tramways), who is the chairman of the branch, was the recipient of a handsome easy chair, the gift of the members of the branch. It was intended as a mark of esteem and appreciation of the valuable services rendered by him on their behalf during the three years he has been chairman of the branch, and also as leader of the officials' side of the Local Joint Staffs Committee. Mrs. Murray was presented with a silver cake basket.

The death has occurred of the **Hon. Edward C. Kitson** in his 48th year. He was chairman of Kitson and Company, Limited.

The late **Mr. R. Baron,** who was motor school superintendent in the tramways department of the London County Council, and who died in December last, was referred to by the Highways Committee as a capable and zealous officer. He entered the employment of the Council in 1905.

The Late Mr. E. Holt.—At a meeting of the Ashton-under-Lyne Town Council appreciative and sympathetic reference was made to the late Mr. Ernest Holt, who for nine years was general manager of the Corporation Tramways. Alderman R. S. Oldham (chairman of the Tramways Committee), referring to the loss the committee had sustained by his death, said Mr. Holt was a very faithful servant, and was the most hard-working and painstaking man he had ever known.

Sir George Carter, managing director of Cammell Laird and Company, Limited, died at the residence of his brother-in-law at Barton, Yorkshire, on February 9. Born in 1860 at Gosport, Sir George spent 25 years in the service of Sir W. G. Armstrong, Whitworth and Company, being appointed shipyard manager at the age of 34 and later a director of the company. In September 1912 he resigned his position at Elswick to become managing director of Cammell Laird. Sir George received the K.B.E. in 1917.

Mechanical Appliances for Handling Railway Traffic. — Mr. George Bulkley, A.M.I.Mech.E., of the Great Western Railway, has written an interesting little book (132 pp., 7 in. by 5 in.), with the object of providing a plain explanation as to the employment of mechanical apparatus suitable for handling and carting general goods. Examples are given of what has already been accomplished in this direction, and suggestions are made for future developments. The book contains numerous illustrations showing various kinds of tackle and machines for handling packages and goods of all descriptions. It is published by the *Railway Gazette*, 33 Tothill Street, Westminster, S.W., at a price of 5s.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Motor vehicles (586)—Sir H. Austin.
Safety car control and air brake equipments (268)—British Thomson-Houston Company, Limited (*General Electric Company*).
Combined air and vacuum brake systems (471)—British Thomson-Houston Company, Limited (*General Electric Company*).
Regulation of combustible mixture in internal combustion engines (241)—A. A. M. Durant and London General Omnibus Company, Limited.

(*Continued on next page.*)

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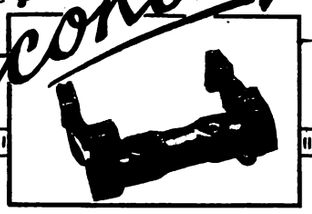

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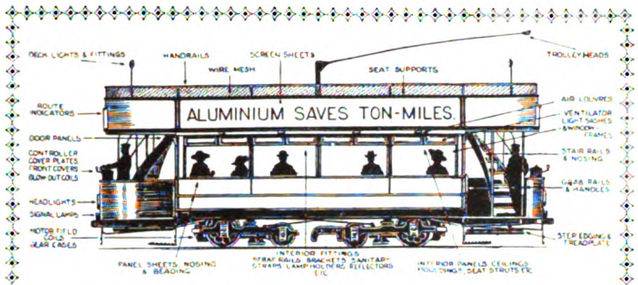

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Lifting jacks (306)—A. Gustiana.
Transmission and/or brake control mechanism of power-propelled vehicles (85)—F. W. Lanchester.
Ignition timing of internal combustion engines (242)—London General Omnibus Company, Limited, and O. W. J. Watson.
Speed indicators for motor vehicles (401 and 402)—A. R. Upward.
Bodies for motor vehicles (532)—C. B. Wardman.
Suspension of power-driven vehicles (302)—E. Zaparka.
Lifting jacks (1,124)—G. P. Appleyard (*G. A. Mortier*).
Steering wheels for motor vehicles (1,106)—W. Buckley.
Lifting jacks (865)—G. H. C. Butler and A. Reeves.
Electrical automatic omnibus sign (711)—H. F. Carey.
Transmission gear of motor vehicles (769)—E. S. Curry and F. Parker.
Mechanical tipping devices for motor vehicles (977)—M. F. Edwards.
Fare boxes (619)—F. Hedley.
Electrically-propelled vehicles (1,137)—P. D. Ionides and Ransomes and Rapier, Limited.
Bodies for motor vehicles (1,254)—R. H. Lea.
Tramway sett (985)—D. McDonald.
Direction indicator for road vehicles (641)—C. Reece.
Petrol supply of motor vehicles (737)—J. H. Simpson.
Devices for securing rails (822)—L. P. Winby.
Emergency brakes for road vehicles (871)—H. E. and W. Ratcliffe and A. Wiseman.
Emergency brake for road vehicles (1,409)—E. Cryer.
Omnibus bodies (1,332)—C. Dodson.
Change-speed gears for motor vehicles (1,649)—M. E. Johnson.
Turnstiles for registering and checking admissions of passengers, etc. (1,436)—London Electric Railway Company and J. P. Thomas.
Steering gear for mechanically-propelled vehicles (1,873)—H. Marles and Marles Steering Company, Limited.
Direction indicators of motor vehicles (1,451)—V. Stuart.
Safety car control and air brake equipments (2,109)—British Thomson-Houston Company, Limited (*General Electric Company*).
Brakes for vehicles (2,193)—G. A. Deadman.
Controlling devices for motors of electrically-driven vehicles (2,089)—F. Krupp Akt.-Ges.
Heat treatment of steel tyres and wheels (2,553)—C. P. Sandberg.
Change speed gear (2,547)—J. B. Smith and R. J. Smith.
Variable speed gears for motor vehicles (2,314)—W. O. Spinks.
Direction indicators for road vehicles (2,639)—V. Stuart.
Steering gears for vehicles (1,909)—F. G. Warbrook.
Passenger vehicles (2,892)—Birmingham and Midland Motor Omnibus Company, Limited, and L. G. W. Shire.
Fare indicators (3,359)—F. W. G. Bruhn.
Brakes for motor vehicles (3,074)—W. Clark.
Electric current collectors for tramways, etc. (2,940)—W. H. Clinkard and E. Nicholis.
Brake or clutch for motor vehicles (2,692)—W. H. Cole.
Lifting jack (2,760)—G. Davies and F. J. Lang.
Motor vehicles (2,975)—J. Patrick.
Omnibus cover (2,874)—R. S. Pulling.
Method of casting brake blocks (2,685)—W. E. Williams.

Specifications Published

1920.

Gear selecting and changing devices for motor vehicles (27,124—*172,448*)—J. Blackburn.
Brake devices for power-driven vehicles (34,434—*154,927*)—Oesterreichische Daimler-Motoren Akt.-Ges.
Jacks and safety brakes for motor vehicles (25,798—*172,709*)—W. Scott, J. B. Goldsmith, and J. Shamsky.
Supporting devices for overhead contact and trolley wires for electric railways and tramways (26,408—*172,735*)—British Insulated and Helsby Cables, Ltd.
Sleeper and chairs for the rails of tramways (35,157—*172,867*)—J. Barrett.
Clutch controls for motor vehicles (26,016—*173,024*)—W. H. Baker, L. Pellat, and V. E. Williams.
Engine starters of motor vehicles (28,698—*173,100*)—A. Harwood.
Lifting jacks (29,109—*173,108*)—A. D. Powell and Lake and Elliott, Limited.
Lifting jacks (33,069—*173,144*)—A. W. Chapman.
Fare systems and means used therewith (26,813—*151,282*)—A. J. Tanner.
Differential mechanism for motor vehicles (28,301—*173,342*)—J. D. Johnson.
Heaters for motor propelled vehicles (18,093—*145,751*)—Perfection Heater and Manufacturing Company.
Motor vehicles (27,594—*173,585*)—S. Coulier.
Bodies of motor vehicles, coaches, etc. (28,770—*173,626*)—W. H. Sadgrove.
Trolley heads for electrically-propelled vehicles (32,003—*173,669*)—R. J. Danson.
Operating mechanism for the speed-gear clutch and brakes of power-driven vehicles (34,667—*155,198*)—Argus Motoren Ges.

1921.

Controlling means for internal combustion engines on motor vehicles (23,774—*168,904*)—Maybach Motorenbau Ges.
Motor char-a-bancs, etc. (3,424—*172,880*)—G. A. Birchley and A. Harvey.
Steering gears for motor vehicles (3,163—*173,440*)—S. E. Alley.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Jan. 8	Jan. 15	Jan. 22	Jan. 29	Feb. 5	1922. WEEKS ENDED Jan. 7	Jan. 14	Jan. 21	Jan. 28	Feb. 4	AGGREGATE. Wks.	1921-22.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	4,034	3.604	3,400	3,435	3,497	3.720	3.327	3,105	2,980	2,974	35½	126.666	− 11.323
Aberdeen Motor Buses	...	22	60	59	60	197	130	127	123	130	35½	8.757	+ 7.800
Ayr Corporation	632	522	547	553	549	554	463	423	423	436	38	28.080	− 1.943
Barrow Corporation	879	880	862	900	892	641	638	632	679	683	44	37,028	− 2.896
Belfast City Tramways	11,064	11.074	11.307	11.309	11.490	12.080	12.255	11.726	11.921	12.175	44	554.111	+ 49.650
Birkenhead Corporation	2,807	2.683	2.722	2.710	2.587	2.625	2.494	2.497	2.401	2.515	43½	115.797	− 12.946
Birkenhead Motor 'Buses	390	357	361	392	364	553	487	503	473	500	43½	29.801	+ 11.420
Birmingham Corporation	33.097	33.220	33.194	32.989	32.842	28.641	28.553	27.422	27.836	27,961	44	1,291.235	− 111.017
Birmingham Motor 'Buses	1.845	1.832	1.879	1.901	1.855	1.650	1.694	1.596	1.618	1.637	44	87.353	− 1.344
Blackburn Corporation	2.431	2.395	2.315	2.512	2.558	2.393	2.132	1.810	2.047	2.172	44½	106.167	− 9.678
Bradford Corporation	14.381	15.119	13.910	14.279	13.975	13.340	13.669	12.288	12.674	13.310	44	604,665	+ 12.314
Burnley Corporation	3.432	3.438	3.222	3.436	3.470	3.234	3.187	2.708	3.088	3,260	—	—	...
Burton-on-Trent Corporation ...	658	677	653	660	644	583	556	561	582	597	44	27,680	+ 497
Bury Corporation	2.489	2.352	2.372	2.478	2.349	2.285	1.958	2.080	2.120	2.160	44½	107.959	− 4.716
Chatham and District	1.474	1.686	1.624	1.629	1.629	1.044	1.472	1.363	1.374	1.544	5	6.796	− 1.247
Chesterfield Corporation	696	640	643	660	665	598	559	517	548	571	44	25.773	− 475
Chesterfield Motor Buses	1.017	880	856	932	926	856	644	485	522	648	44	33.487	− 1.969
Derby Corporation	2.367	2.268	2.364	2.371	2.247	2.069	1.999	1.908	1.985	2.041	44	95.218	− 6.513
Dundee City	3.518	3.202	3.087	3.210	3.196	3.290	2.849	2.691	2.812	2.848	37½	120.403	+ 5.658
East Ham Corporation	2.336	2.287	2.203	2.203	2.153	2.032	2.023	2.051	2.076	2103	44½	93.724	+ 2.077
Edinburgh Corporation	...	...	...	...	...	13.265	12.015	9.576	10.103	10.982	38	483.042	+ 5.369
Edinburgh Motor 'Buses	...	...	...	...	...	3.802	3.085	2.712	2.899	3.222	38	135.836	—
Glasgow Corporation	47.927	44.476	45.428	46.453	47.367	44,896	41.318	39.338	41.458	43.525	35½	1,610.523	+ 8.204
Glossop (Urban Elec. Supply Co.)...	246	237	256	244	225	240	228	219	251	214	5	1.152	− 56
Halifax Corporation	4.618	4 375	4.205	4.380	4.458	3.992	3.793	3.439	3,615	3.676	42½	189.038	+ 1.655
Halifax Motor 'Buses	125	117	117	117	120	66	58	57	57	73	42½	3,402	− 1.500
Halifax Railless Cars	...	...	...	...	...	52	48	27	41	31	28	1.523	—
Huddersfield Corporation	5.173	5,139	5.261	5.255	5.219	4.836	4.887	4.638	4.657	4.970	45	233.945	+ 9.374
Ilford U.D. Council	1,425	890	645*	1,321	1.261	1.420	1,367	1.387	1.370	1.434	44½	66.551	+ 9.516
Ipswich Corporation	897	869	811	831	805	776	705	716	704	757	44	38.224	− 4.877
Isle of Thanet...	570	551	505	520	507	550	525	466	335	528	17½	11.130	+ 1.079
Kilmarnock Corporation	460	350	372	383	372	410	313	303	300	314	37½	13.675	− 368
Leicester Corporation	6.695	6,602	6.619	6.508	6.396	7.085	6.975	6.957	7.307	7.167	5	35.492	+ 2.650
Liverpool Corporation	27.867	26.855	26.516	27.015	26.678	30.332	29.865	27.771	28.085	28.288	5	144.344	+ 9.413
London County Council	104.394	105.949	102.190	102.064	101.406	88.450	87.768	85.827	84.182	92.040	44	4.312.136	+ 227.810
Maidstone Corporation	535	475	419	410	405	536	435	373	361	395	43	21.002	− 451
Manchester Corporation	39.083	38.324	38.171	38.696	38.661	35.880	36.141	34.433	35.903	36.496	44	1.711.151	+ 186.748
Newcastle-on-Tyne Corporation ...	11.573	11.349	11.155	11,707	11.352	10.516	9.529	8.254	9.606	10,358	44	495.002	+ 6.733
Nottingham Corporation	7.590	7.653	7.525	7.678	7.698	7.224	7.419	6.999	6.998	7.840	44	300.342	− 40 977
Oldham Corporation	4.642	4.563	4.650	4.633	4.483	4.332	4.178	4.397	4.307	4.342	46	216.333	− 3.129
Preston Corporation	2.014	2.042	1.937	1.939	2.006	1.873	1.875	1.730	1.717	1.783	43½	83.923	+ 3.533
Reading Corporation	1.620	1.700	1.546	1.594	1.586	1.557	1.488	1.393	1.397	1.430	44	69.831	− 3.547
Reading Motor 'Buses	297	292	262	259	241	323	307	280	255	291	44	14.992	+ 3.320
Rotherham Corporation	2.913	2.696	2.622	2.779	2.829	2.494	2.284	2.051	2.238	2.228	43	97.493	− 17.530
St. Helens Corporation	2.116	2.024	2.039	2.166	2.189	1.696	1.571	1.491	1.574	1.581	44	78.771	− 13.028
Salford Tramways	...	...	10.625	10.858	10.977	...	...	9.409	9.878	10.256	43½	473.655	+ 21.935
Sheffield Corporation...	20.947	20.344	20.569	20.861	20.706	18.584	17.714	17.719	17.833	18.261	44½	862.375	− 63.924
Southampton Corporation	3.251	3.233	3.057	3.103	3.083	2.855	2.867	2.706	2.836	3.039	44	130.388	− 8.690
Southampton Motor 'Buses	333	310	247	210	201	100	95	88	95	103	44	6.805	− 4.068
Southend Corporation	1.631	1.661	1.629	1.630	1.657	1.865	1.764	1.680	1.696	1,881	44	110.384	+ 6.916
South Shields Corporation	1.940	1.845	1.902	1.982	...	1.716	1.574	1.503	1.573	...	44	73.692	− 10.129
Sunderland Corporation	2.995	2.763	2.824	2.830	2,754	2.549	2.154	2.146	2.203	2.432	44	115.511	− 20.243
Swindon Corporation	397	385	362	359	383	369	356	308	310	351	43½	17.341	+ 253
Tyneside Tramways and Tramroads	802	1.115	1.118	1.129	...	473	847	698	784	...	4	2 802	− 1.363
Wallasey Corporation	2.814	2,731	2.698	2.690	2.660	2.706	2.609	2.334	2.340	2,390	44½	123.897	+ 7.510
Wallasey Motor 'Buses	139	138	128	133	. 134	194	215	168	200	175	44½	10.502	+ 2.880
Walsall Corporation	1.929	1,975	1.982	1,997	1.937	1,550	1.480	1.437	1.481	1,529	45	72.485	− 7.795
Walsall Motor 'Buses	1.345	1.376	1.388	1.420	1.388	891	854	792	847	886	45	41.380	− 10.596
Walthamstow U.D. Council	1.969	1.891	1.876	1.914	1.817	1.614	1.557	1.541	1.538	1.710	44½	90.272	− 270
Warrington Corporation	1.012	1.073	1.095	1.090	1.108	1.086	995	980	981	1.047	44	43.913	− 325
West Ham Corporation	6.548	6.512	6.215	6.347	6.141	5.598	5.535	5.348	5.419	5.829	44	260.145	+ 3.732
Wolverhampton Corporation ...	2.407	2.323	2.324	2.307	2.278	2.191	2.111	2.095	2.277	2.137	45	104.998	− 4.200
Wolverhampton Motor 'Buses ...	630	603	616	612	678	622	613	614	666	634	45	29.434	+ 8.800

* Service stopped Sunday to Wednesday inclusive.

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Jan. 8	Jan. 15	Jan. 22	Jan. 29	Feb. 5	1922. WEEKS ENDED Jan. 7	Jan. 14	Jan. 21	Jan. 28	Feb. 4	AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	
Underground Rlys. & L.G.O. Co. ...	...	...	...	...	...	213.332	212.018	199.689	192.358	204.824	5	1,022.221	-
London and Suburban Traction ...	...	...	...	...	...	45.872	45.518	42.557	41.757	45.051	5	220.755	—

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED Jan. 8	Jan. 15	Jan. 22	Jan. 29	Feb. 5	1922. WEEKS ENDED Jan. 7	Jan. 14	Jan. 21	Jan. 28	Feb. 4	AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		85.871	84.171	77.716	75,451	78.096	81,642	83.650	80.745	80.036	81.194	5	407.267	+ 5.962
Calcutta	Rs.	97,982	102.176	102.061	67,439	1,359*	97.904	104.981	102.643	99.220	101,078	5	505.826	+ 134.809
Madras...	Rs.	(2 weeks)	38.198*	(2 weeks)	* Nil	...	(2 weeks)	50.849	(2 weeks)	54.390	...	4	105.239	+ 67.041
Pernambuco	...	4.512	4.789	4.278	4.672	5.013	3.534	3.504	3.639	3.595	3.961	5	18.807	5.850

* Strike of employees.

Companies issuing Monthly Statements only.

		1920. Aug.	Sept.	Oct.	Nov.	Dec.	1921. Jan.	1921. Aug.	Sept.	Oct.	Nov.	Dec.	1922. Jan.	Wks.	AGGREGATE. 1921-22.	+ or −.
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo		3.588	4.192	4.442	4.810	4,601	...	3.809	4.231	4.682	5.137	4,762	...	36	40.287	+ 2.686
Brazilian Trac. Mlrs		11837000	12043000	1344200	219900	...	...	1574400	1471000	1501600	1455500	...	...	48	155.462.00	+ 33156000
Brisbane		46,650	45.430	46.310	...	...	46.280	50.675	46.220	47.880	...	...	48,790	4	48.790	+ 2.510
British Columbia	$	810.608	806.797	835.054	338.842	17.668	...	844.154	345.185	345.973	877.335	340.113	...	26	5,192.915	+ 175.544
Buenos Ayres L'c'z		53.952	53.603	57.619	56.746	38.857	61.111	55.873	55.873	58.492	58.056	33.381	61.198	30	404.817	+ 7.420
Burma		48.553	50.235	55.763	53.696	50.481	50,035	55.168	58.974	64.778	58.271	54.194	59.362	26	350.747	+ 41.984
Cape Town ...		...	23.699	...	25 628	29,768	...	25.164	25.755	26.839	27.004	31.521	...	—	—	—
Carthagena & H. ...		3.721	2.273	3.319	2.714	5,560	3,877	1.773	4.244	3.862	1.717	3.237	3,075	4	3.075	− 802
Cordoba		21.028	19.597	19.627	19.122	19.299	...	23.851	23.204	23.203	22.698	22.641	...	39	207.992	+ 29.564
East India ...		4.109	4.228	4.299	4.234	4.299	...	4.513	4.154	4.054	3.945	4.080	...	26	24.834	− 606
Kalgoorlie... ...		3.111	3.361	3.094	2.969	...	...	2.652	2.829	2.405	2.419	...	...	48	24.944	− 8.728
La Plata		5.715	5.656	6.310	5.573	...	...	...	...	6.587	6.453	...	...	48	58.098	− 3.652
Manila ...	$	292.418	280.352	327.652	320.345	315,599	...	297.128	322.212	323.108	306.850	316,467	...	52	3.681.011	+ 262.605
Monte Video ...		42.771	41.816	45.246	43.846	...	50.863	44.672	44.927	47.927	47.426	...	32.634	13	132.190	− 11 454
Para		24,571	23,174	26.772	24.273	24.253	...	22.940	22.225	25.548	23.147	22.650	...	5	22.660	− 1.593
Port Elizabeth ...		...	5.803	...	6.620	8.185	...	6.578	6.477	6.788	6.828	8.344	...	—	—	—
Rangoon ...	Rs.	117.836	114.857	111.830	104.468	120,000	122,588	133.000	132.225	151.000	137.750	145,500	137,850	4	137.850	+ 15.292
Winnipeg ...	$	368,616	426,647	444.899	477.957	...	...	393.823	417.174	441.315	477.880	...	...	48	4,910.971	+ 156,466

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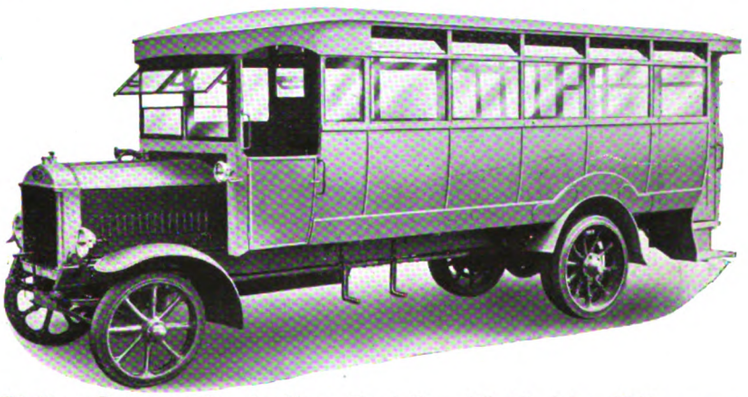

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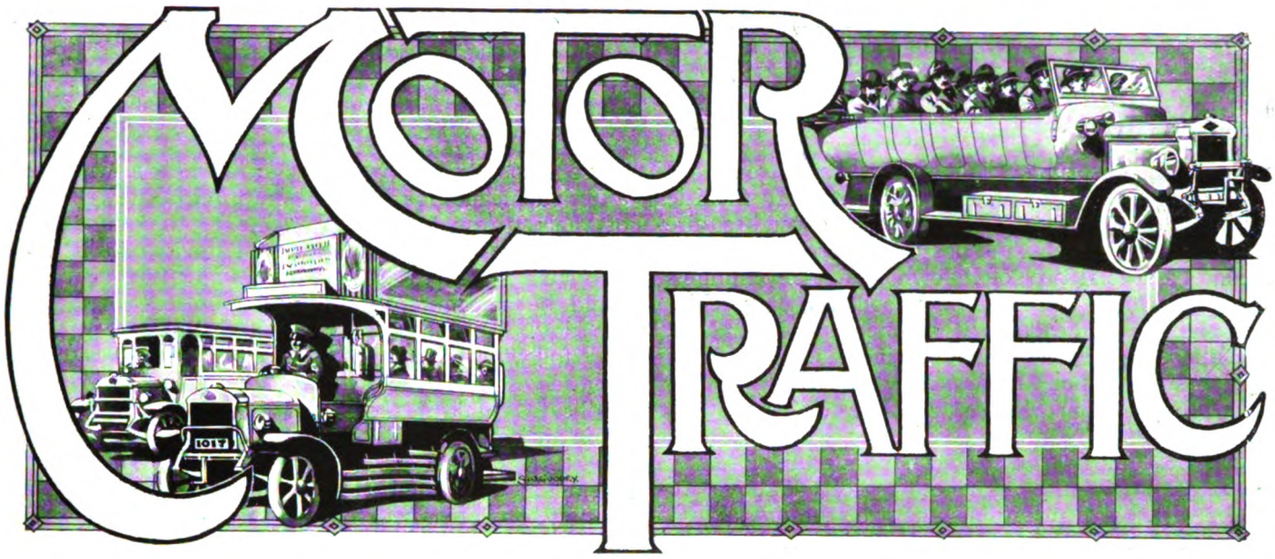

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

THE FUTURE OF THE MOTOR COACH.

While there are obvious economic advantages in employing, for motor coach services, vehicles of very large carrying capacity, the opinion is steadily gaining ground that the future of this type of traffic depends on the development of somewhat less commodious but more handy vehicles, approximating more and more in comfort and speed to the private motor car. It stands to reason that where the volume of custom justifies the employment of very large vehicles, the use of these renders it possible to run a remunerative business without charging unnecessarily high fares. The more we restrict the carrying capacity, the higher must be the average fare paid for a journey of given length. A 16-seater cannot be operated at half the cost of a 32-seater. The saving is not likely to be more than 25 per cent. at the outside and, if the lighter vehicle is fitted with pneumatics and the heavier with solids, it is not improbable that the operating costs will work out at about the same figure in the two cases. This does not necessarily mean that fares must be doubled, because the use of smaller units implies that on the average the number of passengers carried will be a larger percentage of the number for whom accommodation is provided. The average load of a 34-seater is not 34 persons. It may be, perhaps, 20 persons, whereas the average load of a 16-seater under similar conditions may possibly be as much as 13 or 14 persons. In dealing with a given volume of possible custom, the largest actual custom will be obtained by running a considerable number of smaller vehicles and offering a great variety of trips, starting at various hours so that there is something convenient and attractive to every possible customer.

* * *

Despite these facts, we cannot get over the fact that higher fares must be charged for accommodation in the smaller and faster type of vehicle. The change in favour of this type must therefore be supported by reasons sufficiently strong to balance this disadvantage in respect of cost. The main reason is that the large motor coach is unpopular amongst other users of the road, and also amongst those responsible for road maintenance. The net result of this lack of popularity amongst those who do not actually use the vehicles is absolutely certain to be restriction of their use in many districts. If the very cumbrous type of coach could be removed from the roads immediately and replaced by a larger number of smaller machines, the hostile agitation would die down at once, and few, if any, restrictions would be imposed. An instantaneous change is, of course, not practical politics, but the sooner and the more completely the change takes place on a voluntary basis, the fewer will be the restrictions which in a few years' time will otherwise hamper the activity of motor coach proprietors throughout the country. We are strongly of the opinion that before many years have passed, the large type of motor coach so common to-day will be practically obsolete, the traffic now carried by it being taken by vehicles with a maximum capacity of 20 passengers or even less, not of excessive width, unobjectionable from the point of view of overhang behind the back axle, shod with pneumatic tyres, and in practically all respects the equal of the average private motor car from the standpoints of comfort and speed.

TRANSMISSION FOR HEAVY VEHICLES.

If the forecast given above in respect of the future of the motor coach proves to be approximately correct, it is not at all improbable that the development indicated will have a considerable influence upon the design of vehicles for loads of three tons and upwards. So long as there has been a demand for large motor coaches, manufacturers have naturally desired to cater for that demand without complicating their works' programme by the production of special models. This fact has led to the very general adoption of live axle drives on vehicles having a carrying capacity of four or even five tons. The chain drive will never again be popular on passenger-carrying machines. Neither is it at all probable that the chain drive will be retained or reintroduced on any chassis having a carrying capacity of much less than four tons. It is just about at the four-ton mark that the advantages of the chain drive begin to become really important. The main points in its favour are, of course, that it permits of cheaper construction, at the same time

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MOTOR TRAFFIC

reducing the unsprung weight to the advantage both of tyres and of mechanism, and offering ready facilities for the limitation of gear ratios to meet special requirements. The more the passenger-carrying vehicle becomes a special type of its own, or tends to diminish in size, the more will the heavy goods-carrying vehicle be designed specifically for that one purpose, and this will almost certainly mean the increased popularity of chain drives on chassis for heavy loads engaged upon work in connection with which absolute silence is not an essential. The subject is one to which we may return at a later date, merely concluding this note with the remark that the influences indicated above, together with the firm establishment of the live axle as the final drive on private motor cars, have led to a certain amount of misconception detrimental to the employment of the chain drive. The latter, in point of fact, has very marked advantages when heavy loads are to be carried, and must under those circumstances be regarded not as an obsolete system, but as one that has suffered temporarily owing to external considerations in no way reflecting upon its real efficiency or economy.

HAULAGE OF BIG LOADS.

While on the subject of the heavier types of motor vehicle, it is almost impossible to refrain from repeated reference to the serious interference with desirable developments that results directly from the present law in respect of the speed limits of trailer combinations. This law was devised when the trailer was a steel-shod vehicle, often constructed in a somewhat primitive manner, and not originally intended for use in connection with motor transport. The law has served as a deterrent, discouraging improvements which would otherwise have been already perfected. So long as the legal speed of a trailer combination is less than half that of the power vehicle alone, the combination cannot do a bigger ton-mileage of work in the day, and therefore there is seldom any point in using it. Legal axle weights are being somewhat increased, and to take full advantage of this fact it should be legally possible to use trailer combinations at speeds only, say, 25 per cent. lower than those accorded to independent power vehicles. The main argument on the other side is connected with the provision of really adequate trailer brakes but, as already mentioned, this is a problem that has not been properly solved, simply because the law has been such that no compensating benefit could be obtained in return for the cost and trouble of its solution. The difficulties of the problem are not insuperable.

THE FLEXIBLE SIX-WHEELER.

A type of vehicle for heavy loads which has now definitely proved itself a commercial proposition is the flexible six-wheeler in which the driving and the following portions are connected by means of a turntable and universal joints, allowing flexibility in all directions. With a six-wheeler of this type, loads of 7½ to 8 tons can be carried without the axle weights exceeding legal limits. If an independent four-wheeler trailer is also drawn, the load carrying capacity is increased to approximately 12 tons and, if this load could be legally drawn at about 12 miles an hour, those who have heavy loads for transport would be afforded means of materially improving the economy of their transport systems. One of the advantages of the extended adoption of this method would be that in many instances loading and unloading processes could be continued without interruption throughout the day. To make this possible, duplicate trailers and following portions for the six-wheeled vehicles themselves would be required, but the cost of these duplicates would in some trades be saved over and over again by the elimination of the terminal delays otherwise inevitable. The power unit—itself a short wheelbased four-wheeled vehicle or tractor—could be kept usefully occupied with only a few minutes' delay at each terminal for the unhitching of the trailer, the disconnection of the loaded following portion, and the corresponding operations of attaching the duplicates, which would be waiting ready loaded. The trouble about the law is that it will not interest itself in the future, but considers that its work is done when it has legislated for what already exists, ignoring the possibilities of anything fresh being ever introduced. Thus the law penalises the trailer because, in its primitive forms, restrictions of speed are necessary to secure safety. In any new law there must be a very wide loophole to enable increased powers to be accorded, without the delay involved by fresh legislation, to any proposition which does not suffer from the disadvantages taken for granted when the main law was framed. If a trailer combination can be made just about as safe as an independent vehicle, and can be so devised that it will deal with much larger loads without involving excessive axle weights, there is no conceivable reason why the speed of the combination should be absurdly limited. These facts must be taken into account in the new laws and, in so far as it may be impossible to cover them in such a way as to leave the door open to free progress, a loophole, as already suggested, must be provided by giving to some authority the power to reduce—but not to increase—the severity of restrictions whenever a new proposition is brought forward of a kind that justifies such special consideration.

RAILWAYS AND ROAD TRANSPORT.

The London and North Western and Midland group of railways is to promote a Bill early in the present session of Parliament to convey traffic, chiefly goods, by road. The preamble points out that the North Western, Midland and West Scottish group includes the North Staffordshire Railway, which by its Act of 1904 is empowered to acquire and run motor cars or other vehicles for the conveyance of passengers and goods. It is expedient that the London and North Western, the Midland, the Lancashire and Yorkshire, and the Furness Railway Companies should also have similar powers. The companies wish to use road transport for the conveyance of merchandise in any district which their system covers, but not beyond that area. Proper safeguards will be given to traders and competing carriers. The companies do not ask permission to manufacture their own motors. Thus the passage of the Bill should mean a " boom " in the British motor industry.

On February 2 the Metropolitan Municipal Tramways Council, accompanied by Mr. J. Beckett, general secretary of the Municipal Tramways Association, had an interview with Mr. H. L. Thornhill, solicitor of the London and North Western Railway Company, who is acting for the North Western and Midland group in the promotion of the Bill. It was officially notified that the railway companies proposed to withdraw from the Bill at the appropriate time all powers relating to the carriage of passengers by road.

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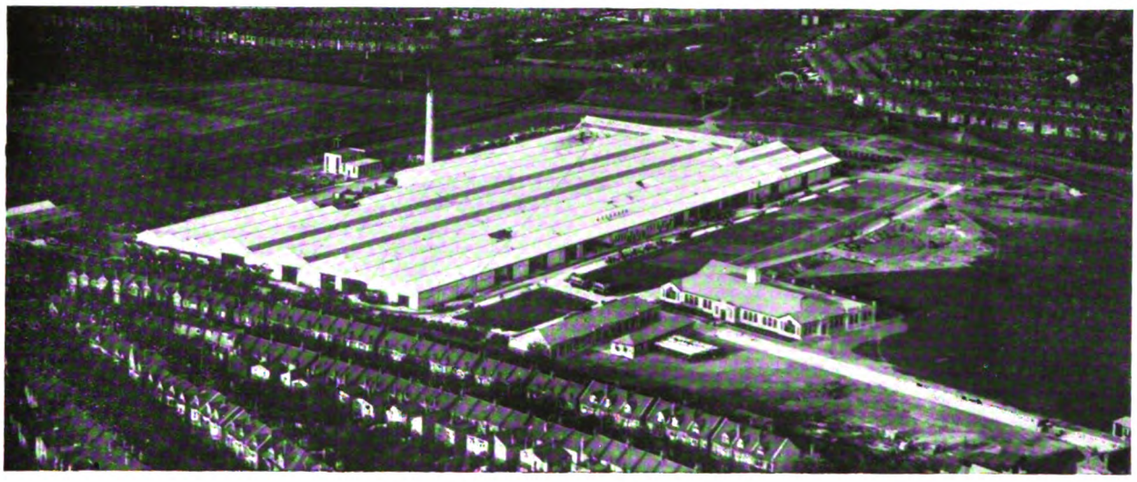
MOTOR TRAFFIC

THE CHISWICK OVERHAUL WORKS OF THE LONDON GENERAL OMNIBUS COMPANY.

A FINE EXAMPLE OF CREATIVE ENGINEERING.

The overhaul works that the London General Omnibus Company have for some time been erecting at Chiswick are now practically complete, and they constitute the most remarkable engineering feat in connection with a motor omnibus undertaking that has yet been achieved. It is claimed for this factory that it is the most modern in lay-out and progressive in system in the world; and that claim is not likely to be challenged. The carefully thought-out design, the highly specialised equipment, and the skilful organisation that characterise the whole undertaking are in the literal meaning of the word unique. For the first time in motor transport the principle of costs production has been applied to repair and renovation work with results that are bound to enhance the notable success of the Metropolitan omnibus service. Before alluding in brief to the principal features of the new works, it may be useful to recall the rapid growth of the motor omnibus service. It is only a little more than ten years since the last horse omnibus of the London General Omnibus Company was withdrawn from the streets, but at the end of October, 1911, all the company's vehicles were motor driven. In that year the company carried 340 million passengers; in 1913 this number had increased to 710 million passengers, and in 1921 to 932 millions. Its vehicles now number about 3,000 and run the enormous total of 107,309,150 miles per annum.

Notwithstanding the immense expansion of its services, the maintenance of its vehicles has been carried out in much the same way as in the early days of motor traction. All annual and dock overhauls of the omnibuses were made at the various garages, some 36 in number, scattered throughout the metropolitan area. Coach factories and stores were likewise dismembered and much time was wasted in intercommunication, superintendence and inspection. The transportation of supplies and vehicles also involved much dead mileage. Altogether the system had become too unwieldy and uneconomical to be longer endured. The circumstances clearly indicated that concentration of repair work would eventually lead to greater economy not only in the actual work of repair but especially in the saving of lost mileage that was inevitable under the conditions then existing. At the close of 1921, the Company's fleet of omnibuses numbered just over 2,830, consisting of three types, viz., 1,565 of the "B" type, 1,056 of the "K" type, and about 210 of the latest or "S" type. This diversity of types had naturally increased the inconvenience of dealing with repair work in scattered shops. It must be remembered—and we recall the fact because many of our oversea readers may not be aware of it—that the Company work under the somewhat stringent regulations of the police department. Each vehicle must be newly licensed once in twelve months after an annual overhaul. Consequently the Company have to make provision for the reconditioning of about 15 omnibuses each working day. There is thus a constant stream of vehicles through the repair shops, and under the old conditions the problem of coping with the work in a satisfactory manner was fast becoming insoluble. After much careful consideration the Company's engineers envisaged the problem as a whole and saw clearly that by applying to repair work the general methods that have proved so successful in manufacture they could overcome their difficulties once for all. Under the former conditions each omnibus was out of service for 16 days during its annual retreat to the shops. Under the new scheme it was thought possible to reduce this interval to four days, and this estimate is now proved to be correct. If the number of omnibuses be considerably increased, the Chiswick works will continue to deal with them as expeditiously as at present. To-day about 60 vehicles are dealt with each week, but the equipment of the factory is such that by merely increasing the number of men employed it will be possible to overhaul as many as a hundred omnibuses per week. It will be readily understood that to design such an installation so as to meet economically the needs of to-day and yet be capable of large expansion was by no means an easy task. Months were devoted to the preparation of plans and the most painstaking consideration was given to the designs of special machine tools required in the various departments. Many of these are of novel and arresting patterns, and by themselves will repay a visit to the works. In this necessarily condensed account it will be impossible to do more than mention a few of the more interesting among them.



Chiswick Works as Seen From the Air. Entrance from High Road.

The actual construction of the works was begun in September, 1920, but progress was much retarded by difficulties in obtaining supplies and equipment owing to the disturbed labour conditions that prevailed throughout the country. Within a year, however, the undertaking was well advanced. The site comprises 31 acres at Chiswick alongside the High Road and just opposite Gunnersbury station of the District Railway, while the line to Ealing passes at the rear. (Adjacent to the site is that of the large repair shops of the District Railway now under construction.) The main building, 857 ft. long and 352 ft. wide, has an area of 300,000 square feet, and is of ferro-concrete construction. Seven acres are enclosed by it and surrounding the building is a wide concrete road. The administration blocks and the canteens flank the entrance road, and on each side of it are large open spaces, much of which will be devoted to a sports ground for the employees. In all, about 16 acres are at present allocated, leaving some 15 acres for extensions.

The buildings are almost entirely of one storey, and as the concrete blocks are squared and jointed the appearance is pleasing and restful to the eye, the tint resembling that of cream-coloured sandstone. The accompanying plans, though reproduced on a small scale, show quite clearly the arrangement of the factory.

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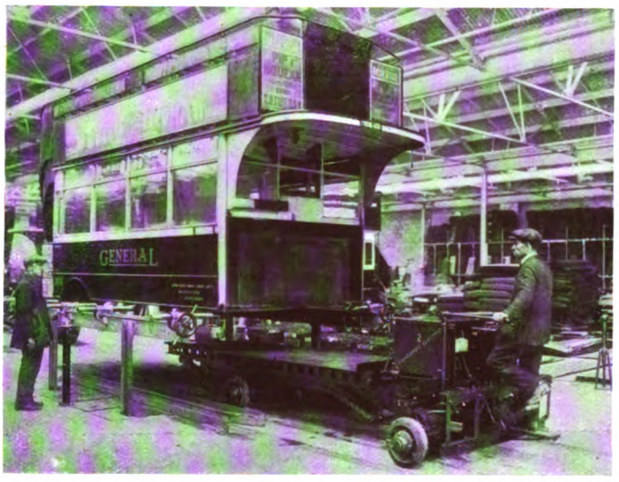
MOTOR TRAFFIC

As will be seen, the works building is divided into three main sections. The body building, repair, and paint shops occupy about one-half of the area, the engine and boiler house and stores take about a third, while the chassis overhaul shop occupies the remainder. At this end of the building are also the electrical and experimental department, the millwrights' shop and tool room. Throughout the engineering sections overhead runways have been installed for moving materials, and pneumatic plant supplies air at 80 lbs. pressure for working various tools.



Body Lifted off Chassis by Hydraulic Lift.

Electric Truck being Run Under Body.

In the lay-out of the plant everything has been so arranged as to provide for a progressive movement of work. Machines necessary for the repair of particular components are grouped in such sequence that the work passes from man to man and from section to section in such a way that there is no waste movement, the materials and parts going forward without loss of time.

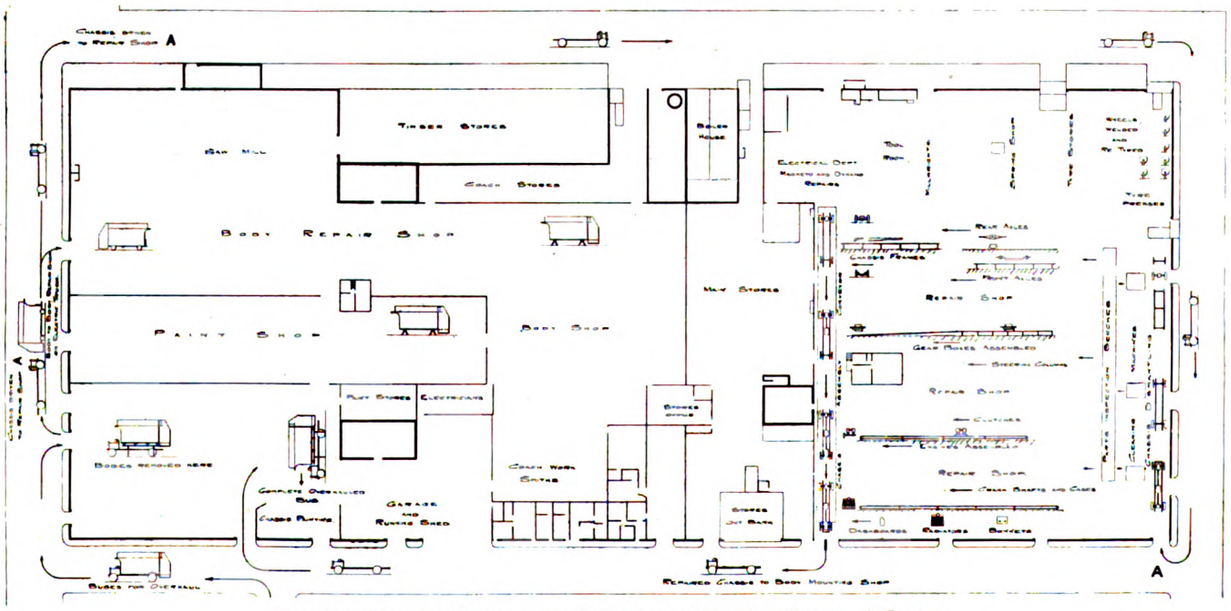


Diagram Showing Sequence of Work at Chiswick Overhaul Factory.

The methods adopted will perhaps best be seen by following an omnibus due for overhaul as it runs down the approach road to the shop. Its first stop is at the licensing department where its licence plates are removed and it then proceeds to the west end of the works. Here the clamps binding the body to the chassis are unfastened; destination and advertisement boards are removed, and with aprons, cushions, etc., are sent to the proper departments. The vehicle is then backed on to a specially designed hydraulic lift, worked by an oil-pump driven by an electric motor, the wheels of the omnibus running in channel irons to ensure correct position without loss of time. While the engine of the chassis is still running the lift raises the body clear, an operation that requires but a minute, and the chassis withdraws, leaves the demounting shop and runs round to a second gate which is located practically in line with the first, but on the opposite side of the factory where it will be subjected to thorough renovation. Both chassis and coachwork, in fact, in their respective departments are by successive stages stripped to their bare bones, each successive dismantling operation following in logical sequence. When this process is complete, reconstruction and repairing follow also in proper sequence.

The body, after the chassis has been removed, is lowered on to an electric truck, manufactured by Messrs. Mossay and Company. This truck has a platform which can be lifted by a gear to the extent of 12 ins. Its platform being telescopic, it will conveniently carry bodies of different types to the body shop, where they are quickly placed on trestles. Only two men are needed for the operations described, which are performed in a few minutes. In the

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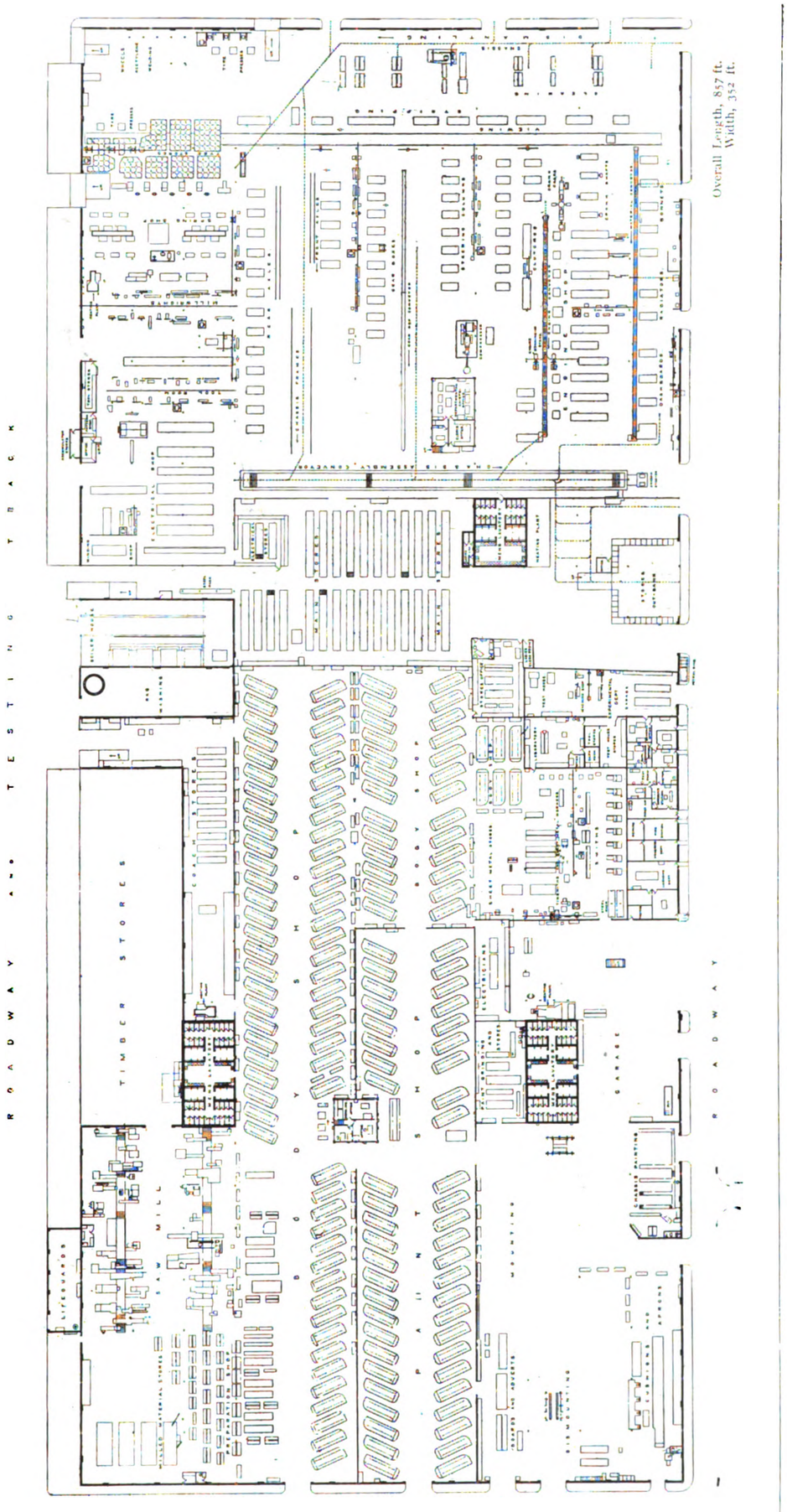

The Chiswick Overhaul Works of the London General Omnibus Company.

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Trimmers' Shop.

Woodworking Shop.

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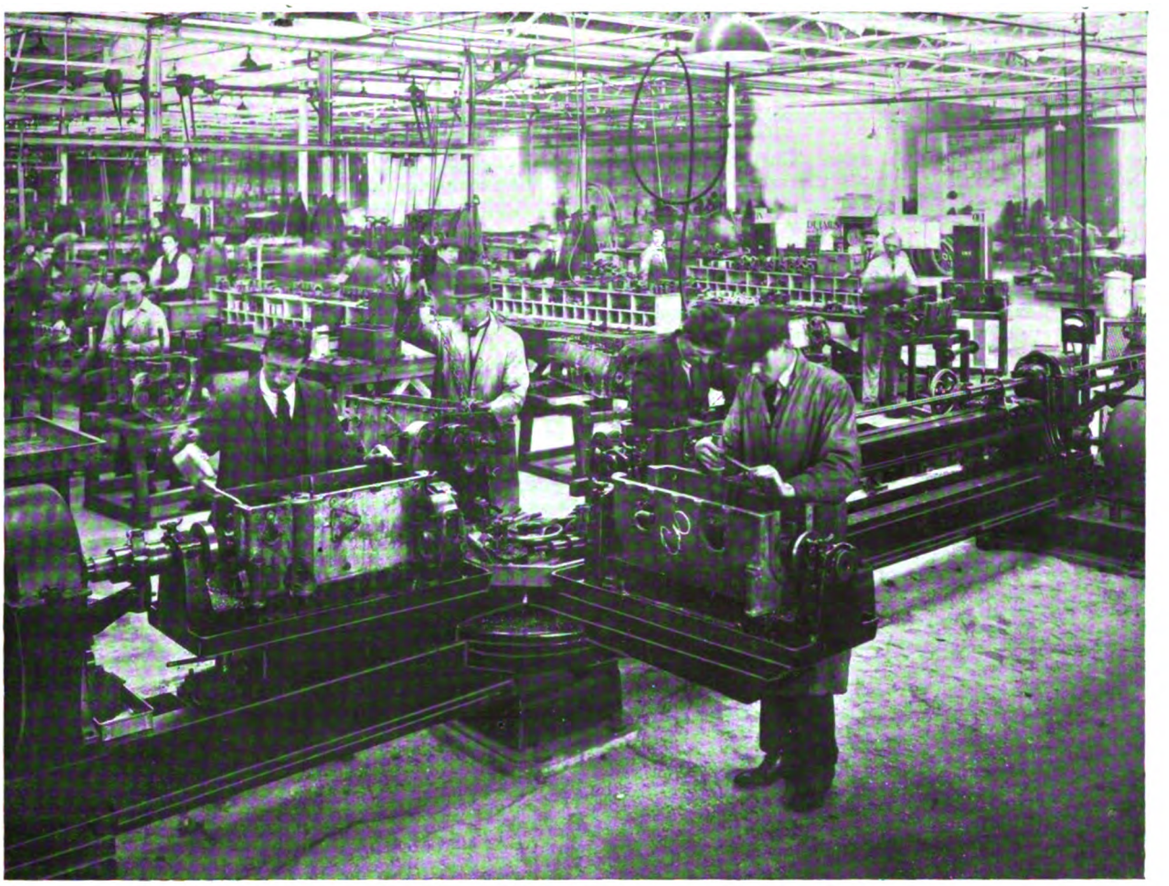

Special Reamering and Crank Fitting Machine.

One of Several Material Conveyors—In some cases Fitters Work on the Parts as They Move Forward.

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body shop is accommodation for 104 units. The lay-out is simple. On the left-hand side, looking towards the centre of the shop, are the timber stores. Alongside are other completely equipped stores, containing all supplies as are constantly needed in the body shop.

The whole of the supplies for these various stores are taken in by a central door on the south side of the factory. So that there may be no unnecessary movement in supplying any parts required at any stage of overhaul, the raw material, as it flows in at the south door, is distributed in due order over the whole range of stores. As these run the full length of the body shop, whatever particular replacement part is needed is almost automatically to hand at any stage. This arrangement is common to both engineering and coachwork supplies.

The bodies are first completely stripped, and then reconditioned so far as their main components are concerned. Following these operations they pass into the paint shop, where there is accommodation for 57 units. Contrary to the usual practice in a big motor factory, the whole of the body painting is done by hand, for essentially practical reasons which long experience has justified. The coachwork, in fact, is painted in four different colours, but no good system has yet been devised whereby one part can be covered, as it must be covered, before any spray process can be used. For flat painting and first coats, good results are obtained by using a broad-bladed palette knife in place of a brush.

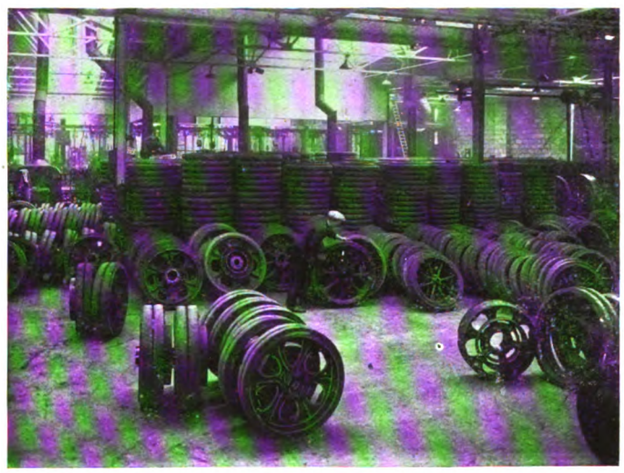
The full time taken to paint and varnish a complete vehicle is five days, an extraordinary performance, considering that the finish is as good as that on the average expensive private car. The painting completed, the body passes into the mounting and finishing shops, where it is fitted with cushions, aprons, boards and advertisements, while the electricians complete the wiring and electric fitting. In the meantime a score of different jobs have been called for, necessitating the employment of smiths, tinsmiths, and other workers.

We may now follow the chassis through its course of dismantling and reassembling. Immediately the engine is stopped, the petrol tank is emptied and the fuel drained, by an underground pipe, into the main storage tank. As each chassis part is taken out, it is removed, by rollway or conveyor, according to its size, and completely dismantled. Each part is tested and inspected before it journeys down the line of workers and benches. The stores are drawn on for the replacement of parts which have become worn. Radiators, bonnet-boards and petrol tanks are the first components to be dismantled. The very thorough radiator washing provision is unusually interesting, serving, as it does, the dual purpose of throwing up every weakness and sign of wear, and preparing the component for repair.

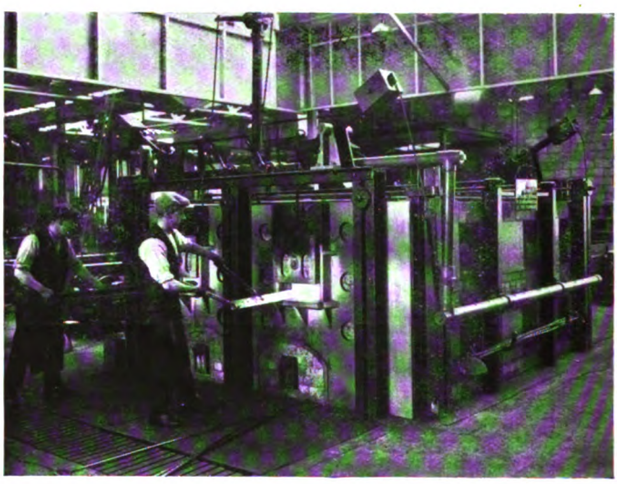
One of the greatest difficulties confronting the motor repair shop is that of obtaining perfect cleanliness in parts grimed and greased by a year's work. The special washing machine, designed at Chiswick to overcome this trouble, is the most successful effort of the kind yet conceived. This machine takes the form of a big-diameter tunnel, carrying, on its inner diameter, coiled piping perforated with many thousands of $\frac{1}{8}$ in. holes. A high temperature caustic solution is forced through the perforations by means of a 6 in.

Advertisement Section.

Testing Repaired Springs.



Wheel Store.



Gas Fired Spring Furnace.

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MOTOR TRAFFIC

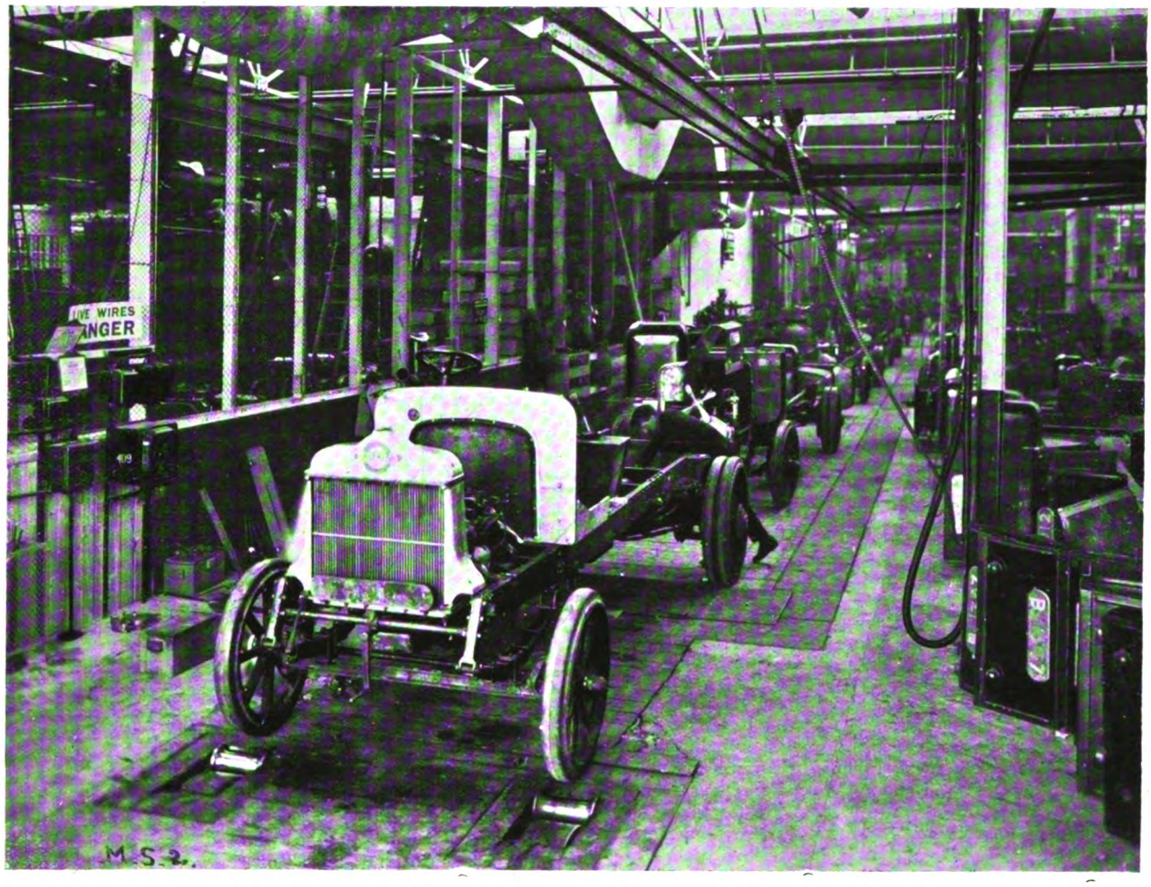
pump, the result being that thousands of high-velocity jets play on every part, from every angle, as the component passes through the tunnel on an automatic conveyor. Three machines of this type are installed. As each is capable of accommodating five components, such as gear boxes, at one time, the total capacity of the washing plant is easily calculated.

As the chassis passes along the shop, it is gradually stripped of engine, clutch, gear box, brakes, back and front axles and steering gear, and all other fittings, down to the bare frame. The wheels go into their own special shop for re-tyring, the tyres themselves being taken from the store immediately adjoining. The springs are re-heated in a double-ended reverberatory gas furnace, with a capacity of 120 springs a day, partly because it is impossible to detect incipent cracks without such treatment, and partly to remove the fatigue brought about by months of wear; also for re-tempering. After tempering, each spring is tested to a fifty per cent. overload in a spring testing machine made by W. & T. Avery, Limited. The millwright's, tool room, and electrical departments are also located in this section of the works.

After the frames have been inspected, repaired and passed as fit for further service, the re-tempered springs are mounted, and the embryonic chassis begins what may be called the outward journey through the works—in other words, reassembling begins. As the frame passes along towards the main moving platform which runs practically the full width of the shop, front and rear axles are also being reassembled until, when they actually reach the main conveyor, they practically fall into position.

Once on the main platform, rebuilding is chiefly a matter of bolting the various units into position. The total length of the platform is 220 ft., and one may walk up the full distance and see, in the course of an hour or so, a chassis completely assembled. The accompanying illustration of the factory lay-out shows very clearly the respective paths of the various components from the time they are stripped from the chassis until, completely rebuilt and tested, they reach the main platform. At exactly the right moment they arrive at the platform ready to drop into the chassis. Gear boxes and rear carden shafts, steering boxes and drop arms, hand brake and gear levers, and all the ordinary complicated gear of a chassis which, however, seems to lose complication and to be simplicity itself when handled in this methodical manner. In due order the parts make their appearance.

As the frame and transmission nears the end of the platform, the time arrives for the engine installation. The rebuilding of the engines deserves particular mention. There is a remarkable boring, reamering and running-in machine installed centrally between the point where the engine is first taken from the chassis and the point where, completely rebuilt, it joins up on the main moving platform. This boring, reamering, and running-in machine is worthy of special attention, for it is unique. It was designed in the Chiswick works. A noteworthy point about it is that it reduces what was formerly a two-day task for skilled fitters to a twenty-minute affair for a machinist.



Chassis Assembling Platform with Engine Starting Device in the Foreground.
This platform moves very slowly, and five squads of men add component parts as the chassis passes their respective sections. Less than three hours elapse during the erection of the chassis.

With the re-metalled bearings bolted down in position exactly as when the crank shaft is installed, the whole crank case is gripped in a jig which makes the ordinary lengthy business of "lining-up" unnecessary. The boring bar is sent through; jig and job together are swung over to the second arm of the machine, and the reamer gets to work; the top half of the lining is removed, the actual crank shaft to be used in the engine dropped in, the lining is replaced, and the machine starts its last operation of "running-in" the shaft. It is amazingly simple and effective.

In the meantime all other engine parts are being overhauled. Worn cylinders, rings, pistons, gudgeon-pins, timing gears and bearings are renewed or passed as fit for further service, all eventually being assembled on a moving platform. When the chassis has moved far enough up the main platform, the engine, complete with

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all its auxiliary gear, leaves the moving conveyor ready to be dropped into place and bolted down.

Radiators, tanks, electric equipment, and details by the score, are fitted in due order, and to a decimal part of an inch. It is not enough that they be perfect in themselves, but it is demanded that they fit with almost microscopic exactitude in their relation to all other parts on the chassis. The system ensures it. If there be any deviation, the system brings it right home to the particular section, gang foreman, view-room man, bench, and actual worker concerned.

The chassis is completely erected by the time it has reached the end of the platform. The radiator is filled; six gallons of petrol are fed to the fuel tank; engine, gear box and back axle have already been supplied with their fixed quantities of lubricant; every knuckle, grease-cup, bearing and joint has received attention; a tester climbs into the driving seat, the chassis passes on to a further position, where the engine is started by a machine operating through the rear wheels, and the unit leaves the shop under its own power for the first test run.

Outside the works testing roads have been built, with a rough surface and a gradient of 1—15, approximately as severe a test of brakes and pulling power as the chassis is likely to experience in the course of ordinary service. This testing place, constructed as a part of the general scheme, involved the making of eight hundred feet of graded roadway with a double hill. From the excavations all the sand and ballast required for the buildings were obtained. Having successfully passed the running test, the chassis is handed over to the licensing department of the works, by whom it must be approved before going further.

The vehicle runs on to its registered track, the coachwork has preceded it by electrical truck, and is held in position on multiple hydraulic jacks similar to those used for dismounting the body in the first place, but in this case the heads have each some degree of universal play to allow for any slight lack of register in the bolt holes of coachwork and chassis. The nuts are screwed home on the holding-down bolts, the battery terminals are coupled up for final test before being submitted to the police passing station—a clean sheet from the authorities being necessary—and the vehicle "passes out," fit for another 30,000 miles of running.

In any short and necessarily condensed account such as this it is impossible to give detailed attention to a host of interesting matters. With the help of the drawings of the factory lay-out, an excellent idea of the whole scheme can, however, be obtained. It must be understood that as every part of either coachwork or chassis is dismantled, it immediately begins a journey which brings it out, either repaired or replaced, at the exact moment and position where it is needed in the reassembling of the whole job. The location of all the stores and offices is worth noting; moving platforms and conveyors are utilised on a bigger scale than in any other factory in Europe. Both the 6 in. per minute engine conveyor and the ingenious gear box roller have exceptional interest.

A very modern experimental shop has been provided. In the laboratory raw materials, fuels and lubricants are tested. There is a dark room for photographic tests and there is a first-aid and rest room where accidents can be treated without delay.

The buildings and plant of this splendid overhaul depot were constructed to plans prepared by the Company's own staff, of whom Mr. G. J. Shave is chief engineer and operating manager; Mr. C. Leese, the engineer in charge of the works; Mr. Owen W. J. Watson, experimental and research engineer; Mr. S. Gage, factory superintendent; and Mr. G. Rushton, production engineer. A visit to the Chiswick works will enable any engineer familiar with modern workshop practise readily to appreciate the ability and resource which these officers and their colleagues have devoted to their task. If, indeed, any reader is inclined to assume that British engineering is to-day lacking in constructive imagination or in its application to new problems, we would commend to him a study of the Chiswick works.

Electric Vehicles Reduce Rates.—The Finance Committee of the Islington Borough Council recommended a reduction of the rates by 1s. 4d. in the £. This has been made possible by, amongst other economies, the saving of 4s. a ton in the cost of refuse collection and street cleansing effected by the use of electrically operated vehicles in place of horse traction. The saving on these services amounts to £14,000 per annum. The vehicles now in use are Edison battery machines supplied by Electricars, Limited, an illustrated description of which appeared in our issue of January 19.

GUILDFORD TO GLASGOW.

DENNIS OMNIBUS'S REMARKABLE RUN.

Some of the vehicles exhibited at the Scottish Motor Show at Glasgow were driven there by road, and owing to the weather conditions this proved a severe test for the machines and a trying ordeal for the drivers. The experiences of Mr. A. S. Hellawell, of Messrs. Dennis Brothers, Limited, who drove a "Dennis" 36-seater' 40-H.P. single-deck omnibus all the way from Guildford, were the subject of an interview in *The Scotsman*, from which we note that on some parts of the journey the snow was 6 ft. high on both sides of the track.

"I first encountered a most violent snowstorm," said Mr. Hellawell, "on the famous Cat and Fiddle Hill in Derbyshire, another between Manchester and Huddersfield, and thereafter the whole way to Edinburgh was bad. Leaving Berwick, we encountered drifts on the Lammermoor Hills of from 5 to 6 ft. deep, varying from a quarter to half a mile in length. There it had been too deep for a snow plough to work, and a way through, the width of a cart, had been cut. The omnibus—far wider than the track—had to force its way through the walls of frozen snow, cutting the sides away with the front mudguards. The journey of one and a half miles through the snowdrift took nearly four hours, the difficulty being not in driving but in steering, which was literally a two-man job, as the hub caps and wheels continually embedded themselves in the snow banks."

Notwithstanding the great difficulties encountered, the "Dennis" omnibus was able to arrive to scheduled time and, in spite of the scratching and tearing through the frozen snow, the machine looked remarkably well. It is interesting to note that the petrol consumption of this 36-seater vehicle, fully loaded, is 7 to 8 miles to the gallon, while it will run 1,000 miles on 1½ gallons of oil. On arrival at Glasgow the omnibus took up its position on the stand of Messrs. Rossleigh, Limited, where its performance, which had been the subject of favourable comment in the Scottish press, attracted to it a great deal of attention.

SIMPLIFYING FOREIGN EXCHANGE.

There is an interesting feature of "Universal Exchange and Interest Tables,"* by Mr. A. J. Lawson, M.Inst.C.E., which will be of particular interest to tramway managers, in that it recalls the suggestions made at the last annual conference of the Municipal Tramways Association in regard to the need for a simplified decimal coinage, and the subsequent correspondence on the matter in these columns. As its title implies, the book consists almost entirely of a series of clear and well-arranged tables, intended, as the preface points out, "to find other and more flexible means of arriving at a correct determination of equivalent monetary values in all currencies and at any rate of exchange, however abnormal." Such tables are, it is observed, rendered necessary by present quotations of exchange having rendered obsolete the old tables of equivalent values in British and foreign moneys. Particularly noteworthy is the author's use of the florin and "cent" in calculation of exchanges, or, in other words, the sub-division of the two-shilling-piece into "farthings" of a new value, giving 100 to each florin instead of 96. The additional new farthing is introduced in each sixpence, and the author's opinion is that very slight effort in mental arithmetic would be needed if we adopted the recommendation contained in the report of the Royal Commission, dated February 23, 1920, that "decimals should be used in the calculations of exchange, and be afterwards reduced to shillings, pence, and decimals." The following are instances of the proposed new sub-division—

Two shillings	=	100 (100 cents)
1s. 6d.	=	75
1s. 0d.	=	50
6d.	=	25

Thus the £1 sterling is equivalent to 1,000 cents. One cent is added at 3d., the second cent at 9d., the third at 1s. 3d., and the fourth at 1s. 9d. in each florin (f.). The departure from strict accuracy is thus in no case greater than one-half farthing. The sovereign would still remain the prime standard of value in the world's exchanges, and the author believes its decimalization into florins, farthings (or cents), and even lower, without other change in the currency, will enormously facilitate the calculation of foreign money values.

* "Universal Exchange and Interest Tables" *from Foreign Trade Tables.* London Thomas Skinner & Co. pp. 242. 15/- net.

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TAXATION OF MOTOR VEHICLES.

RECONSIDERATION URGED BY MOTOR LEGISLATION COMMITTEE.

In a memorandum submitted to the Minister of Transport by the Motor Legislation Committee, it is stated that the duties imposed by the Finance Act 1909-10, were estimated to produce £410,000 on the vehicle tax and £375,000 from the petrol tax, or a total of £785,000. They in fact produced the following revenue—

Year ended March 31.	Petrol Tax.	Car-carriage Tax.	Total.
	£	£	£
1910	320,703 } ...	1,061,923 ...	1,823,002
1911	440,376 }		
1912	623,782 ...	1,019,813 .	1,643,595
1913	738,781 ...	1,119,919 ...	1,858,700
1914	841,384 ...	1,279,801 ...	2,121,185
1915	964,382 ...	1,263,763 ...	2,228,145
1916	1,793,117* ...	1,259,087 ...	3,052,204
1917	1,976,031 ...	1,000,811 ...	2,976,842
1918	1,698,922 ...	764,059 ...	2,462,981
1919	2,221,911 ...	981,009 ...	3,202,920
1920	3,000,487 ...	1,642,553 ...	4,643,040
1921 (approx.)	2,430,227 ...	7,200,000 ...	9,630,227
Total	...£17,050,103	£18,592,738	£35,642,841

* (1) Petrol duty doubled, August 1915.
(2) The 6d. Petrol Licence Duty imposed in 1916 amounted to a sum of £933,000 not included above.

The increases in petrol duties in 1915 and 1916 were war measures designed to limit motoring and the consumption of petrol, and do not affect the general proposition. At the conclusion of the war, the problems of road maintenance and improvement were affected by the obvious difficulty of obtaining the promised State contribution towards road maintenance in view of the heavy prior commitments. The Road Fund was diverted to the Exchequer from August 1915, to March 1920, so that in fact money provided under a specific bargain for a definite purpose was, under abnormal conditions, utilised for the general purposes of the State, to a total of over £11,000,000. Of this total, however, some £8,000,000 was subsequently returned to the Road Fund.

It was in these circumstances that the interests of mechanical road transport were invited to co-operate with the Ministry of Transport with a view to finding a specific sum for road purposes. It is material to note in the interim report of the Departmental Committee on Taxation and Regulation of Road Vehicles that "the problem before the Committee was the raising of an annual net revenue provisionally estimated at £7,000,000." The schedule of duties proposed by that Committee as shown in the appendix to that report estimated to produce a gross revenue of £9,025,000 and a net revenue, after deduction of costs of collection and payments to local authorities in lieu of carriage duties, of £8,125,000. The Chancellor of the Exchequer, in his 1920 Budget, stated that "in a full year the new taxation should yield £9,000,000, which . . . should leave £8,400,000 to the Road Fund." Sir Eric Geddes, on April 20, quoted a certain resolution adopted by all mechanical road traffic interests that if it could be established that the proceeds of the tax would exceed the sum required, there should be a proportionate reduction all round on the basis of 15s. per H.P. on private motor vehicles. He further stated that it was "agreed that £7,000,000 or £8,000,000 a year is necessary," and again on April 27 that the object "is to raise roughly £8,000,000 a year."

In a statement made on behalf of the Motor Legislation Committee during the passage of the Finance Bill, 1920 (a copy of which is attached hereto), it was specifically admitted that the controversy was "not under existing circumstances a question of the amount of taxation . . . but one entirely of method." At a deputation from the Motor Legislation Committee received by Sir Eric Geddes on May 5, 1921, a very definite undertaking was given that if the money was found to come in in excess of the estimated Budget, mechanical road traffic should not have to go on paying that excess when it would not be necessary on the agreed Budget. "If," he said, "twelve millions were realised, that revenue should not be allowed to continue without their having a chance of talking about it."

The position now is that for the first ten months of operation of the schedule of duties a gross sum of £10,437,997 was received, so that including horse carriage licences it is fair to assume a gross revenue approaching £11,000,000 for the full year, or a net revenue of over £10,000,000 for the Road Fund, as compared with the £7,000,000 stated by the Departmental Committee to be required and £8,000,000 subsequently assumed to be the figure which the mechanical road transport interests had agreed. In other words, the net revenue at a time of great industrial depression is from 20 per cent. to 25 per cent. in excess of the agreed Budget.

If the normal increase in mechanical road traffic continues, it is probable that a revenue exceeding £12,000,000 gross or £11,000,000 net will be forthcoming during the financial year ending December 31, 1922, while it is not unlikely that the cost of road maintenance will decrease instead of increase as compared with the past year.

The Motor Legislation Committee reasserts the contention which was placed before the House of Commons in 1920 that taxation of motor spirit remains the most equitable method of raising the greater part of the revenue required. The petrol imports for the past year will approximate 240,000,000 gallons, so that the flat rate of 4½d. per gallon suggested by the Committee would, as stated, have produced by itself over 50 per cent. of the revenue stated to be required. It was further stated on behalf of the Committee that the proposals of the Finance Bill "are already having and will have a prejudicial effect not only on the motor trade of the country, but on the normal development of economical road transport."

The fears of the Committee have been fulfilled, and the almost unanimous reports of motor manufacturers and dealers and users of private and commercial vehicles indicate that the high scale of direct vehicle taxation has been a very important factor in a pronounced restriction of the development of motor transport. The suggestion made by the Committee that the system in operation "will benefit those users of motor vehicles who can afford to pay, and operate unjustly on the vehicle owner of more moderate means," has been fulfilled to the letter. There is no question that direct vehicle taxation, while representing on a mileage basis a comparatively small increase over the old petrol duty in the case of those large owners of commercial and public service vehicles whose user is regular and continuous, has imposed a very serious hardship upon 90 per cent. of the owners of these and other types of vehicles.

It is for this reason that the Motor Legislation Committee still maintain that before the Budget of 1923 the whole question of the possibility of a reintroduction of a duty upon motor spirit should be reconsidered in the light of petrol imports and the production and use of other forms of liquid fuel.

Apart from the question of method of taxation, the Committee respectfully remind the Minister—

(*a*) That the Government has failed to make its own contribution towards road maintenance expenditure, and that the whole of its burden as contemplated by the Finance (No. 2) Bill 1914, is being borne by the special taxation.

(*b*) Of the resolution referred to in paragraph 5, and quoted by the Minister in 1920 in support of the schedule, that in the circumstances which have actually transpired there should be a proportionate 25 per cent. reduction in the schedule.

(*c*) Of the very striking confirmation of this understanding expressed in 1921 by the late Minister of Transport.

(*d*) Of the fact that the British motor industry is passing through a period of the most acute financial anxiety.

It is in these circumstances that the Committee feel that they have every reason to expect that the Finance Act 1922 will reduce the schedule of taxation contained in the Finance Act 1920, on an all round basis of 25 per cent., to take effect from January 1, 1923.

The Committee maintain that this tax on the motor industry is to be deprecated. Manufacturers and dealers of motor vehicles should receive the utmost assistance possible from the Legislature at a time of the most real financial anxiety. A sum of approximately £100,000 has been received from these licences, and it is not always recognised that most of the vehicles used under the trade licence subsequently pay their appropriate duty.

The Committee are as anxious as the Minister and the police to ensure that these licences shall only be used for strictly legitimate purposes, and for that reason they suggest that the whole question of the amount of duty and the conditions of use of the general identification licence should be reviewed at the earliest opportunity.

The memorandum is signed by Sir W. Joynson Hicks, chairman, and Colonel A. Hacking, general secretary.

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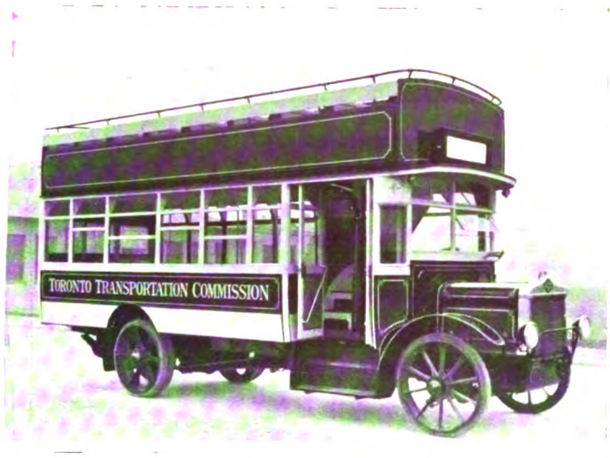
MOTOR TRAFFIC

A.E.C. OMNIBUS FOR TORONTO.

CONVERTIBLE FROM SINGLE TO DOUBLE-DECK.

The accompanying photograph is of a new pay-as-you-enter type omnibus supplied by the Associated Equipment Company, Limited, of Walthamstow, to the Toronto (Ontario) Transportation Commission. The body (the registered design of which is covered by British patents in many countries) is convertible from single to double deck, and the time taken to make the transformation



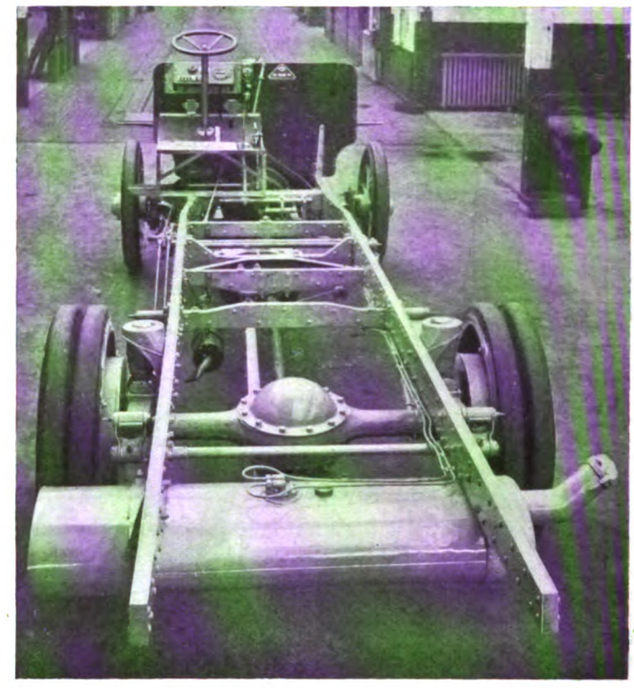
View Showing Upper Deck in Position.

either way is under one hour. Double doors are situated at the forward end of the right-hand side of the vehicle, and are controlled by the driver through a lever at his side. The driver's seat is on the left-hand side, and the stairs to the upper deck are installed at the rear of this seat. The leading corners of the body are rounded off.

Used as a single-deck omnibus, the vehicle has accommodation for 29 passengers; in the double-deck form, 27 outside and 27 inside can be seated. The interior seats are upholstered in Utrecht

The Omnibus as a Single-Deck View.

velvet, whilst those on the outside are of the ordinary garden slatted type. An emergency door is fitted at the rear to comply with local regulations. When running as a single-deck omnibus the staircase hatchway is closed in with a trapdoor. All windows are of the silent drop non-rattling type, and can be fixed in any position. The coachwork is beautifully finished, and the vehicle as a whole presents a charming appearance. The colour scheme is as follows—Bottom panel, lemon chrome; middle panel, lake; top deck, lake; pillars, lemon chrome; lines in gold. The words "Toronto Transportation Commission" appear in gold letters lined black along the sides. Illuminated destination indicators are fitted at the front and rear. The lighting is provided by standard L.G.O.C. double-deck equipment, with two generators, the interior fittings being of pleasing ornamental pattern.



Chassis of New Toronto Omnibus.

The chassis is the standard London "S" type, with the exception of the gear box and back axle. The former is the new 4-speed type, and the latter the banjo type, as fitted to chassis for provincial work. The steering is arranged on the left-hand side. A 30-gallon petrol tank is situated at the rear, petrol being fed by pressure to the carburetter.

OMNIBUS SERVICES.

ABERDEEN.—The Provisional Order promoted by the Corporation includes an application to extend the tramway department's omnibus system at a cost of £30,000.

BERLIN.—The *Electrotechnische Zeitschrift* announces that arrangements have been made for the establishment of three routes of electric accumulator omnibuses in Berlin. The service will be commenced with 80 vehicles, each providing 20 seats and 18 standing places. Re-charging will be effected at the company's stations.

BRISTOL.—The Tramways and Carriage Company who operate tramway and omnibus services on over 600 miles of road in Somerset, Gloucester, and Wilts, now issue their official time table monthly. The services, which are frequently being extended, make it possible to travel by road to Bridgwater, Street, and Frome in the south, Tewkesbury or Broadway, via Gloucester, in the north, and via Swindon to Faringdon or Hungerford in the east.

CHESTER.—On the advice of the chief constable, the Watch Committee have refused to grant licences for omnibuses on routes where there are already efficient omnibus services.

DONCASTER.—The Corporation Bill to be heard in the ensuing session includes an application for powers to run omnibuses by the tramways department within the borough and on certain roads in outside districts. The total length of roads scheduled is 21 miles.

HULL.—At Hull Watch Committee the chief constable submitted an application from the general manager of the Grimsby Street Tramway Company on behalf of the Provincial Tramway Company Limited, for two hackney carriage licences in respect of two 31-seat

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MOTOR TRAFFIC

corridor coaches. The application stated that these would only be used during the summer months for pleasure parties for half and full day tours from Hull, and would not be run in competition with existing local services from Hull. The chief constable reported the result of inquiries as to the practice followed in other districts with regard to allowing omnibuses from outside to ply for hire. The application was granted.

NELSON.—In view of recent price reductions, Nelson Town Council are again considering the advisability of inaugurating motor omnibus services.

NEWPORT-CARDIFF.—Cardiff and Newport Corporations have now agreed as to the conditions regarding a motor omnibus service between Cardiff and Newport.

NOTTINGHAM.—The Tramways Committee have authorised a new omnibus service between Upper Parliament Street and Bulwell Market.

PARIS.—On January 19 the first-class fare on the Paris omnibuses was raised to 50 c. The fare for the first stage of second-class travel remains at 25 c. The result of the change was an increase of traffic on the underground railways and an increased use of taxi-cabs.

ROTHERHAM.—The Tramways Committee are communicating with Rural District Councils regarding proposed extensions of motor omnibus services.

SHEFFIELD.—An application for a licence to run omnibuses between Millhouses tramway terminus and the city boundary has been refused by the Watch Committee.

SOUTHAMPTON.—On January 14 the Corporation Tramways Department offered for sale, by advertisement in our columns, six motor omnibuses, double decked, with a seating capacity of 42.

LEYLAND OMNIBUS'S FINE RECORD.

The Leyland single-deck omnibus shown in the accompanying illustration is in service between Crumlin, Cwmfelinfach, and Newport (Monmouthshire). Originally an R.A.F. "Leyland," the vehicle was reconstructed for the Western Valleys Omnibus Services, and was placed on this route on August 1, 1921. During four months' running it has covered 15,606 miles. When it is reckoned that this works out at nearly 1,000 miles a week, for roughly 16 consecutive

Leyland Omnibus on South Wales Service.

weeks, it will be seen that the performance is highly creditable and affords striking testimony of reliability and sound construction. The reports on its working, in fact, show that the Leyland has proved very satisfactory in these daily runs. A glance at the illustration reveals the sturdy construction of the omnibus—a feature of importance when the nature of the roads in this hilly district of South Wales is borne in mind. It will be observed that in addition to ample side-windows, the roof is constructed to admit additional light to the interior. The ventilation is adequate and the upholstery comfortable. The service on the Newport-Crumlin route covers ten miles and serves a well-populated district

MOTOR VEHICLES FOR MUNICIPALITIES.

MANCHESTER CORPORATION have purchased a 4-ton motor tipping wagon for the cleansing department.

RIPON COUNCIL have asked the surveyor to make inquiries as to the cost of a 30-cwt. petrol tipping wagon.

MANCHESTER TRAMWAY COMMITTEE have purchased two Lacre motor sweeping machines of the three-wheel type.

WORCESTER ELECTRICITY COMMITTEE are considering the purchase of a five or six ton petrol lorry for haulage purposes.

BRIDLINGTON COUNCIL have secured sanction to borrow £944 for the purchase of a steam wagon and three trailers.

CALCUTTA CORPORATION have been recommended by a committee to invite tenders for the supply of eight electric lorries.

WORCESTER COUNCIL are being asked to consider the advisability of introducing mechanically propelled vehicles for street cleansing and watering.

ST. PANCRAS COUNCIL reports that two electric vehicles are working satisfactorily, and are economical, the cost of collection by electrics averaging 13s. 11d. per ton, compared with 15s. 8d. per ton by horse vehicles.

STRETFORD URBAN COUNCIL have adjourned for two months from January 14 consideration of a motor transport department. The officials are to prepare particulars upon which to enable a sub-committee to base recommendations.

PAISLEY CORPORATION have been asked to test a new apparatus which can be fitted to any make of motor wagon for sweeping streets and collecting the refuse at the same time. The apparatus, which has been patented, will cost from £150 to £200.

SYDNEY (N.S.W.) COUNCIL have received a letter from Karrier Commercial Vehicles regarding the purchase of an Elgin street sweeping machine and an Elgin auto-gutter sweeper, claiming that the patent Karrier combined sprinkler, road sweeper, and refuse collector would carry out the combined work satisfactorily and at a cost considerably below that of the two sweepers. The Council, nevertheless, have resolved to purchase the two American machines.

ISLINGTON BOROUGH COUNCIL have borrowed £8,237 for the provision of four 2½-ton electric dust vans, together with charging apparatus. In March last the Council borrowed £57,110 for the purchase of battery vehicles for street watering and refuse collection, also charging plant and garage accommodation. As a result of the experience gained in the use of these vehicles, it is found that one motor vehicle replaces two horse-drawn vehicles for dust collection and four horse-drawn vehicles for street watering. A reduction of costs has also been effected.

DUNDEE OMNIBUS DISPUTE.

COMPANY'S ACTION AGAINST CORPORATION.

In the action in which the Dundee, Broughty Ferry and District Tramways Company seek to interdict the Dundee Corporation from running a motor omnibus service to and from Broughty Ferry, the record has now been closed in the Court of Session. The plaintiffs state that in October last the Sub-Committee of the Corporation Tramways Committee, with the view of testing the amount of traffic on the route, agreed to run a motor omnibus service from the High Street to Castle Green, Broughty Ferry, with power to extend the journey to the end of the esplanade. Plaintiffs contend that the proposed service is *ultra vires* of the defendants, and as ratepayers and as undertakers carrying on a tramway, the plaintiffs object. The route of the omnibus service extends over four miles, and it is held that part of it would be in competition with the plaintiffs' tramways, which form a junction with, and act as an extension of, the Corporation system.

The Corporation hold that the plaintiffs, as statutory tramway undertakers, have no right to complain of the omnibus service, and that the service being within the statutory powers of the Corporation—under Section 50 of the Dundee Corporation Order and Confirmation Act (1907)—an interdict should be refused. The service objected to, they urge, is experimental, and is being run solely for the purpose of testing the amount of traffic on the route.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

TRAFFIC REGULATION IN PARIS.—In order to reduce traffic congestion, slow moving traffic, including motor vehicles weighing with their loads 8 tons, have been forbidden to use a number of the principal streets of Paris between 2 and 7 p.m.

COACH BY-LAW AT REDHILL.—The Town Council have adopted a by-law under which the police can prosecute passengers in public vehicles using noisy instruments to the annoyance of the residents, and for throwing money to be scrambled for by children.

INCREASED OMNIBUS FARES AT MIDDLESBROUGH.—The Ministry of Transport has authorised an increase of 100 per cent. in the omnibus fares charged by the Middlesbrough Corporation, and the question of charges will be considered by a sub-committee of the Tramways Committee.

GLASGOW LICENCE DUTY DISPUTE.—The Education Committee of Glasgow contend that their motor vehicles used for the conveyance of crippled children, etc., are exempt from licence duty. The magistrates have recommended that the Town Clerk take proceedings in order to have the point determined.

A YEAR'S MOTOR ACCIDENTS IN GLASGOW.—According to a statement by the Town Clerk there were during 1921 accidents involving 604 motor vehicles. The number of persons killed was 37, while 567 were injured. For reckless driving or exceeding the speed limit 268 persons were prosecuted, and the number convicted was 253.

LONDON COACHING SEASON.—The Samuelson Transport Company have advertised that beginning on February 1 their coaches will start at 2 p.m. daily (bad weather excepted) from the National Gallery to make trips round London. It is intended to visit chief points of historical interest. The company's headquarters are now at Page Street, Westminster.

WEIGHING HEAVY VEHICLES.—As some public weighbridges have been broken by heavy motor vehicles beyond the capacity of the weighbridges, Glasgow Corporation propose to issue a warning to drivers. The question of the responsibility of the Corporation for the maintenance of public weighing machines is also to be investigated. Meanwhile motor owners will be held liable for any damage occasioned.

ENGINE AT THE REAR OF THE CAR.—The motor correspondent of the *Birmingham Post* states that the biggest innovation at the Berlin Motor Show was that introduced by Rumpler. The passengers sit in a boat-shaped body without a bonnet, the engine being at the rear, and forming a unit with the back axle. This method of construction enables shorter cars to be built, yet gives better accommodation and greater riding comfort.

HEIGHT OF FRONT ENTRANCE STEPS.—Oxford Watch Committee have had correspondence with the manager of the City of Oxford Motor Services with reference to complaints respecting certain motor omnibuses having entrance from the front only. The committee inspected the vehicles, and decided to inform the company that the steps are too difficult, and should be made easier, and to suggest that if this cannot be done a short ladder should be provided.

THE RECEIPTS FROM TAXES.—The Ministry of Transport, in a return of the tax collected in Great Britain in respect of motor, etc., licences issued from January 1, 1921, to November 30, states that the total gross receipts amount to £10,212,458. The figure is subject to some adjustment. The total gross receipts into the motor tax account to December 31 were—England and Wales, £9,378,648; Scotland, £940,504; total, £10,319,152. The total gross receipts from Ireland were £265,695.

LONDON'S BUSIEST OMNIBUS CENTRES.—During the morning peak load period omnibuses pass Charing Cross to the number of 598 per hour, or, approximately, six a second. In the evening rush hours the figure is 592. These figures make a record for winter conditions, though the peak load record for summer time is higher still. During the busy hours the S type 54-seat omnibuses on the route between Shepherd's Bush and Liverpool Street follow each other at intervals of 90 seconds, so that this service alone is able to transport, in a single hour, 4,320 passengers past any given point.

LONDON ROAD SCHEME.—At a conference of representatives of the Surrey County Council, Kingston Corporation and adjoining districts, on January 10, a resolution was carried that it was desirable to proceed with the scheme for the construction of the proposed arterial road from Kingston Vale to Esher. The scheme provides for a road 100 ft. wide, and the estimated cost of construction, including the acquisition of land, is approximately £290,000. Colonel Brassey, chief engineer to the Ministry of Transport Roads Department, stated that half the cost would be borne by the Government.

EX-SOLDIERS IN THE MOTOR INDUSTRY.—The Central Committee for the Employment of Discharged Soldiers and Sailors, which was formed at a conference held at the Royal A.C. in January 1916, has completed their work. Over 3,500 men have advised the committee of having obtained situations. The committee have reason to believe that many more men obtained appointments to which the committee had introduced them, but did not subsequently acquaint them of their success. In Ireland the Royal Irish A.C. found employment for 943 men. The president of the committee was the Hon. Sir Arthur Stanley.

PROCEEDINGS FOR MOTOR OFFENCES.—Under the Roads Act 1920, the power of dealing with offences in reference to motor vehicles is transferred from the justices to the Commissioners of Inland Revenue. The first offences dealt with in Portsmouth came before the Finance Committee of the Town Council. A fine of 20s. was inflicted for using a side car for which a licence was not in force, and fines of 10s. were imposed for using an unlicensed lorry and car. A prosecution was ordered in a case in which it was alleged that there was fraudulent use of an identification mark and of a licence, and fraudulently lending a licence to another person.

TRANSPORT MINISTRY AND OMNIBUS BY-LAWS.—Bournemouth Corporation have received a letter from the Ministry of Health referring to draft by-laws submitted by the Council, and stating that the Minister of Transport had appointed a Departmental Committee on the taxation and regulation of road vehicles, including in its purview the general question of control of omnibus traffic. The Minister therefore doubted how far it was expedient for the authority for a district comprising parts only of omnibus routes to attempt to deal with the question for the present, and he thought the Council would be well advised to defer the matter.

WINTRY ROADS AND WHEEL SLIP.—In places where the snowfalls during January were heavy, motor vehicles that were not suitably equipped experienced considerable difficulties. Solid rubber tyres will not grip on a steep hill when the road is covered with frozen snow. The trouble is remedied by the provision of chain grips for the rear wheels. With a very slippery surface it is desirable to provide chains for the front wheels if anything like speed is desired. Omnibuses and lorries equipped with giant pneumatics obtain a good hold on dry traffic-hardened snow and also on slush, but on a frozen road it is necessary to provide chains.

LORD WEIR AND THE MOTOR INDUSTRY.—In an article in the "Motor Year Book" for Scotland, Lord Weir states that British car makers overlap and duplicate expensive engineering effort, and have too little standardisation and output. The result is excessive costs and prices. The customers in the world markets and also in our own domestic market "are daily becoming poorer, and are going to remain poor for many years. Nevertheless they require cars because they cannot afford to do without them, but these must be of a utility character. The true obstacle to the British utility car lies in the lack of conception of a design which will enable production possibilities to be realised."

TRANSPORT LECTURES AT LIVERPOOL.—As the fourth of a series of lectures on inland transport arranged by Liverpool University Department of Commerce, Mr. C. le Gosselin on January 16 lectured on "A Survey of Mechanical Road Transport." Referring to the proposals of railway companies to institute road services, the lecturer contended that railway companies should concentrate upon the efficient development of their own form of transport, and not waste their energies in an endeavour to eliminate competition. Road transport, by its general performance of the past twenty years, and the special services it had rendered to the community in times of anxiety had won the right to be allowed free development in competition with other forms of transport, and was worthy of a separate and distinct existence.

TILLING-STEVENS JANUARY ADVERTISEMENT.

Owing to an unfortunate oversight the advertisement of Messrs. Tilling-Stevens Motors, Limited, of Maidstone, in our issue of January 16 contained a block and letterpress relating to an *Evening News* article. The advertisement should have appeared as now printed on the opposite page.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MARCH 16, 1922. VOL. LI.

THE OPERATION OF A SELF-CONTAINED TROLLEY OMNIBUS SYSTEM.

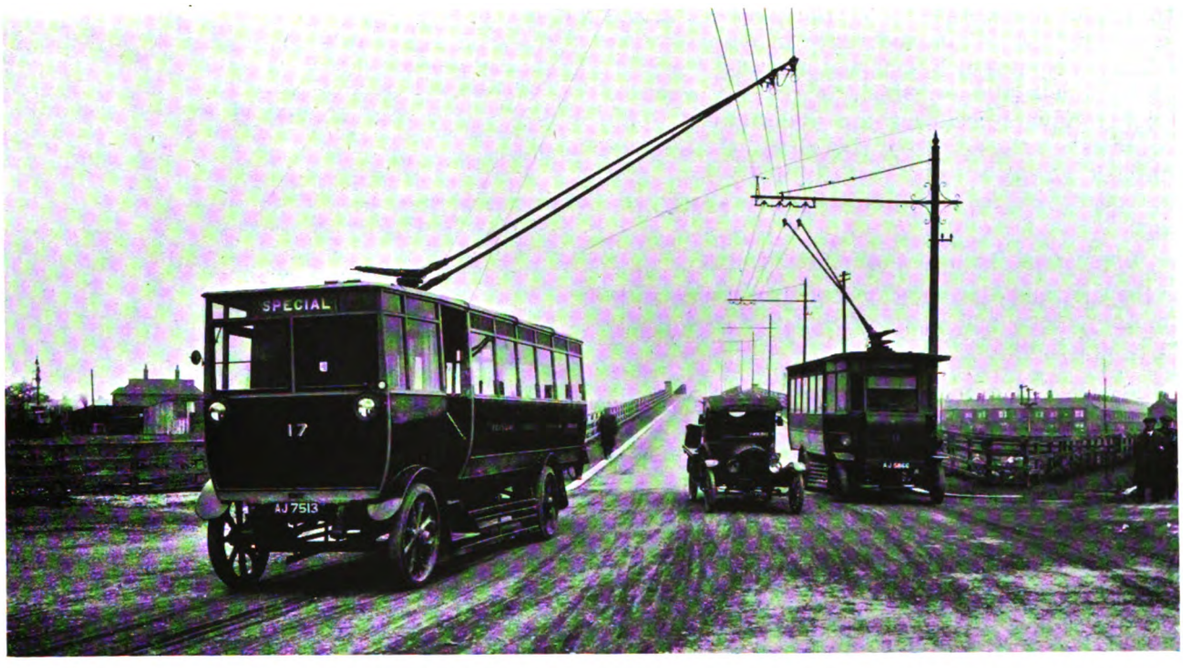
By J. B. PARKER, A.M.I.A.E.
(*General Manager and Engineer, Tees-side Railless Traction System*).

Up to the present only two self-contained trolley omnibus systems have been inaugurated in this country, but recently there have been numerous comments and discussions relating to the merits and future prospects of such systems. Such discussions especially concern tramway undertakings where the track is practically worn out, and the cost of renewal at the present day prices would be outrageous and prohibitive, especially so in sparsely populated districts. The writer has of late received numerous inquiries from tramway authorities, both in this country and abroad, respecting the working of the particular self-contained trolley omnibus system for the operation and management of which he has been responsible during the last 18 months. For the benefit of all interested, he has pleasure in giving a brief account of its operation since the commencement of service in November 1919.

This system is controlled by the Tees-side Railless Traction Board, which is composed of representatives of two local authorities, viz., Middlesbrough Corporation having one-third interest, and Eston Urban District Council having two-thirds interest. The joint authorities purchased the undertaking in 1919 from a private company that had been formed "pre-war" to give a service to the intermediate thickly populated, industrial districts of both areas.

Owing to the war conditions the undertaking was not completed before the negotiations were settled for the purchase by the joint authorities. The system was then eventually completed, and was officially opened by the present chairman, Councillor W. G. Grace. A service was commenced on November 8, 1919, with ten 28-seater, single deck, trolley omnibuses, over routes (shown on the accompanying map), approximately 5·1 miles in length, serving a population of approximately 45,000, and giving a ten minutes' service over the main route.

This service was not sufficient to meet the public demands. The omnibuses were subjected to excessive overloading, which, in conjunction with the very bad condition of the roads *en route*, proved injurious



Vehicle Drawn to One Side of Road to Show Reach of Trolley Arms, viz., 14 ft. from Centre of Vehicle to the Wires.

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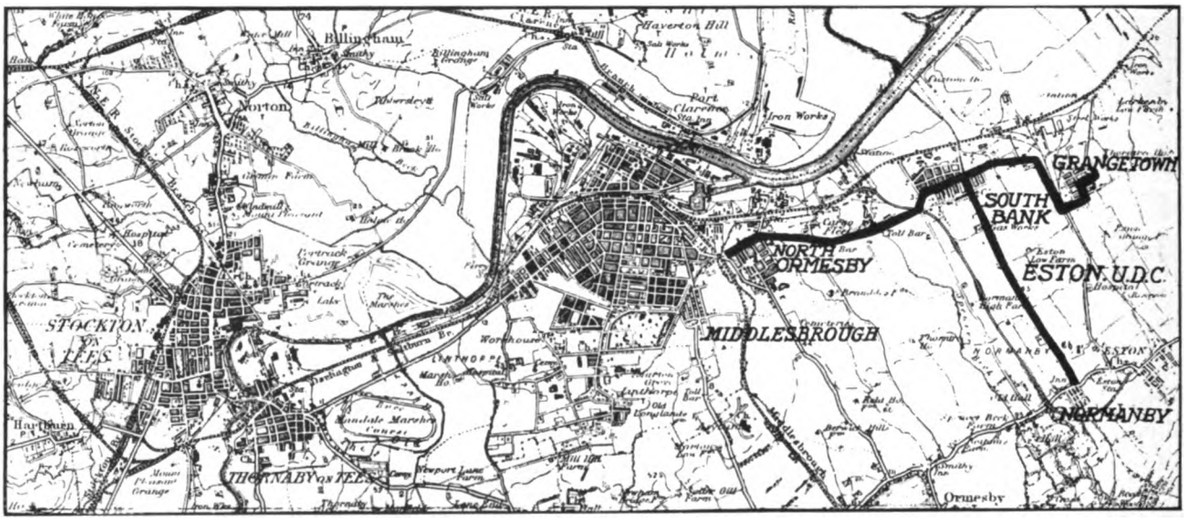
to the vehicles. In July 1920, a further six trolley omnibuses were installed, and the undertaking was then put into proper working order, giving a service which the travelling public could rely upon. Since that date a scheduled service has been efficiently maintained. Needless to say, the more efficient service gained the confidence of the passengers, and the number carried immediately increased. The recent trade disputes and slackness in trade, however, caused a gradual decrease which temporarily retarded the further advancement of the undertaking. This will be seen from the accompanying chart, which shows the number of passengers carried, miles run, and receipts per week for the first two complete years' running.



Plan of Tees-side Railless Routes in November, 1919.

First and Second Complete Years.

For the first and the second complete years, ending November 7, 1920 and 1921 respectively, the traffic return is as follows—

	First Year.	Second Year.
Traffic receipts	£27,684 2 11	£29,476 14 10
Number of passengers carried	3,270,683	3,344,276
Number of miles run	319,731	382,258
Number of units used	451,720	567,801
Average receipts per car-mile...	20·78d.	18·51d.
Average number of passengers carried per car-mile	22·34	20·26
Average number of cars in service	11	13
Average number of miles run per car per annum	29,066	29,404
Average number of units used per car-mile	1·41	1·48

It will be seen that the total traffic receipts for the two complete years up to November 7, 1921, amount to £57,160 17s. 9d., an average of 19·54d. per car mile. This amount averages £5,604 per route mile per annum over the above period, and has been achieved with the following statutory fares—

Ordinary passengers	One penny per mile
Workmen	Halfpenny per mile

As the ratio of workmen carried to ordinary passengers is one to three, the average fare charged is thus equal to ·87d. per car-mile, a figure which is probably the lowest fare charged by any authority over the same period in this country. This should not be lost sight of when comparing the financial position with similar electric traction undertakings.

The total operating costs for the two complete years equals 17·57d. per car-mile (as shown by the following table), which leaves a net revenue balance of 1·97d. per car-mile.

Revenue Account, Two Years ending Nov. 7, 1921.

Expenditure.

To Traffic Expenses—	
Wages of motormen and conductors	6·24
Cleaning and oiling of cars	·56
Fuel, light, and water for depot	·05
Ticket check, including wages of inspectors and clerks	1·14
Uniforms, etc.	·01
Miscellaneous	·32
	8·32
To General Expenses—	
Salaries of general officers and staff	·83
Rents	—
Rates and taxes	·59
Printing and stationery	·21
Fuel, light, and water for offices	·01
Accident insurances and compensations	·20
Fire and other insurances	·10
Miscellaneous	·25
	2·19
To General Repairs and Maintenance—	
Bridge	·05
Electrical equipment of line	·54
Building and fixtures	·06
Workshop tools and sundry plant	·41
Cars	4·95
	6·01
To Power Expenses—	
Cost of current at ⅜d. per B.O.T. unit	1·05
Total Amount of Working Expenses	17·57

Capital Expenditure.

The total capital outlay over the above period is as follows—

	£	s.	d.
Permanent way—bridge	14,033	17	10
Electrical equipment of line	13,571	10	9
Land	2,752	4	1
Buildings and fixtures	6,428	17	2
Workshop tools and sundry plant	584	18	3
Cars (including electrical equipment of cars) ...	28,822	12	11
Other rolling stock	486	6	0
Miscellaneous equipment	550	10	0
Office furniture	98	18	6
Parliamentary expenses	3,655	3	4
Preliminary expenses	544	11	6
Total	£71,529	10	4

Equivalent to £14,025 per route mile.

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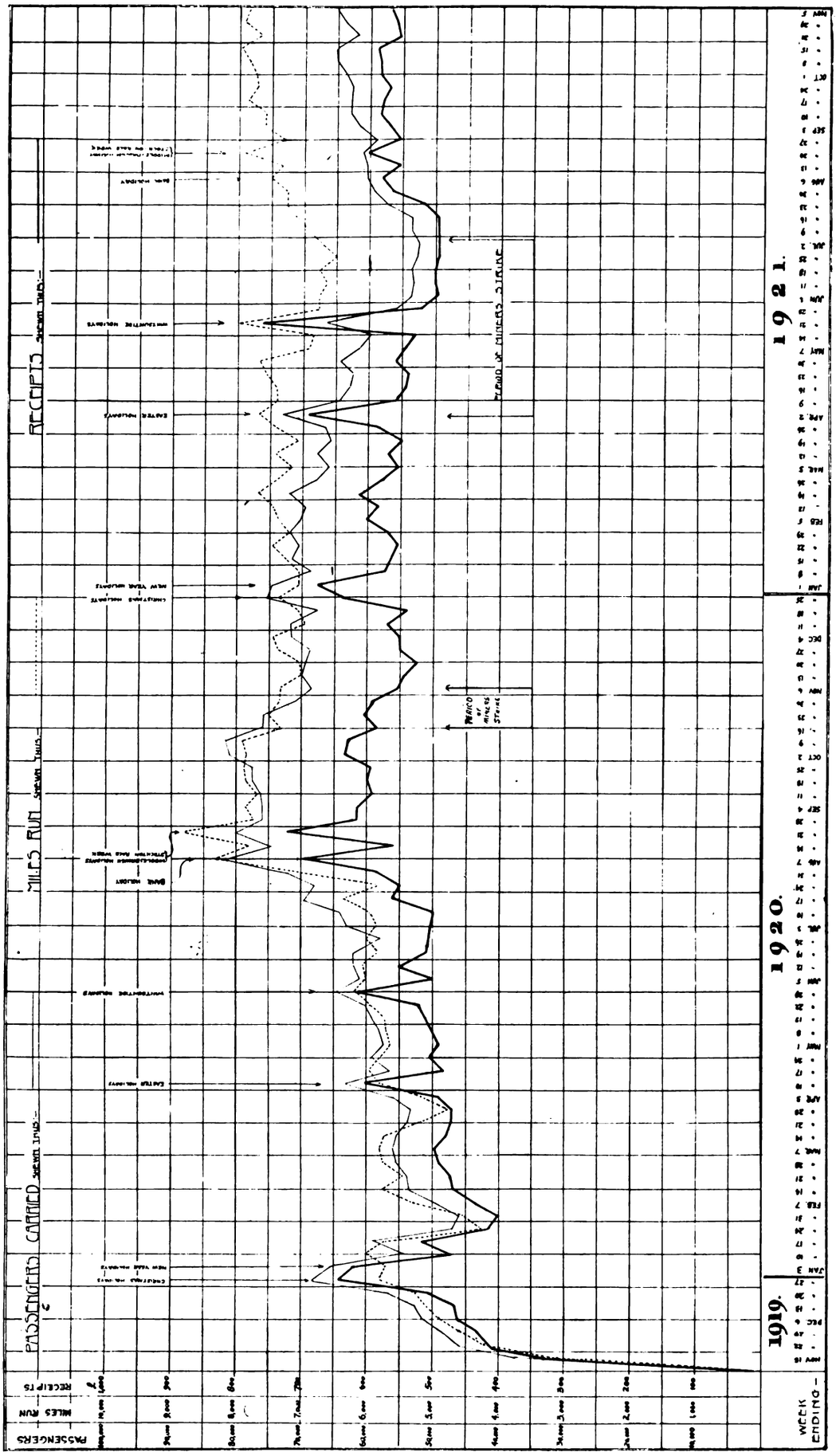

Chart Showing Number of Passengers Carried, Miles Run, and Receipts per Week for the First Two Complete Years' Running of Tees-side Railless Trolley Cars.

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The interest and redemption charges thereon are borne by the two constituent authorities. Owing to the fact that the net revenue balance of 1·97d. per car mile is not sufficient to meet such charges, an application was made to the Ministry of Transport for powers for the undertaking to increase their fares under the "Tramways Temporary Increase of Charges Act 1919." This was not sanctioned owing to the fact that, the system being self-contained and not attached to a tramway undertaking, there was no provision in the Act to allow for granting such increase of fares. Thus it requires a new Bill to be promoted to include self-contained railless undertakings before increased fares can be charged, which, in our case, is most unfortunate and unfair.

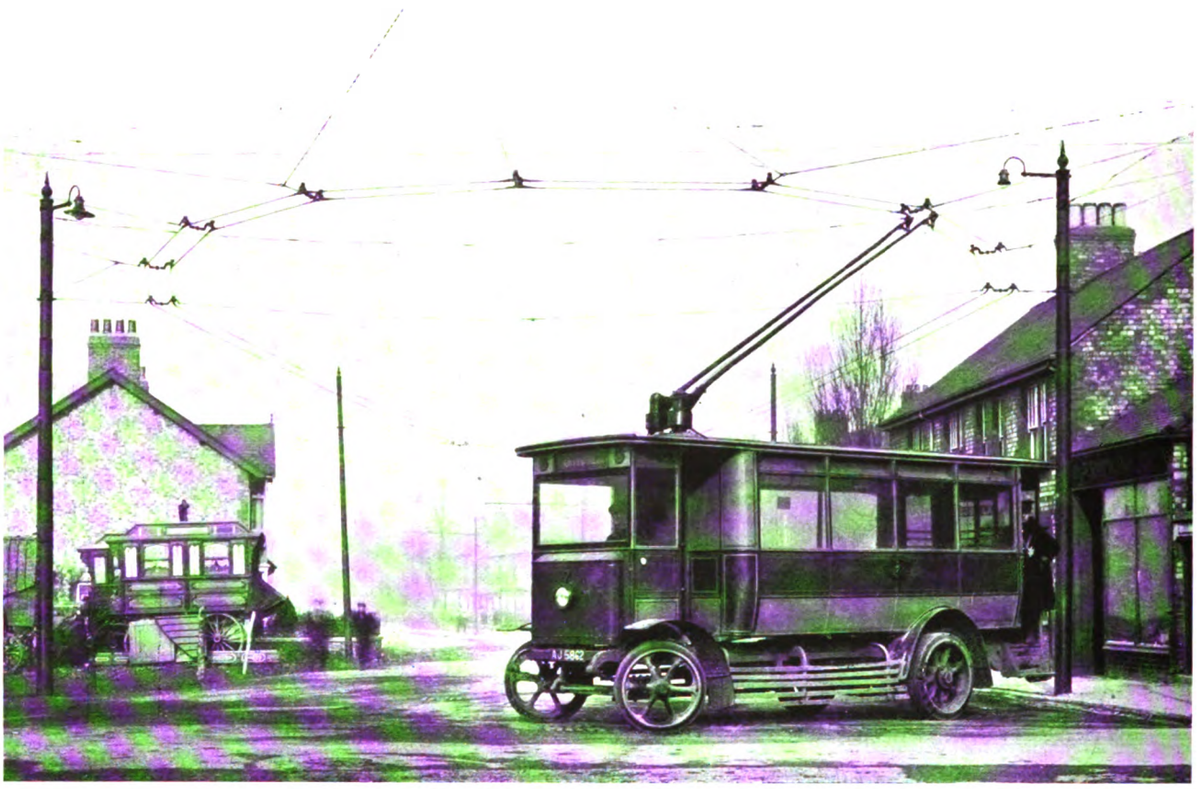
ROLLING STOCK.

The first ten vehicles put into operation were of the single-deck type, each seating 28 passengers. These are fitted with two 20-H.P. electric motors side by side in the chassis, driving on a twin worm gear rear axle by two cardan shafts with universal couplings, fitted at each end on to the motor and worm shafts. There are emergency mechanical brakes fitted at the rear end of each motor independent of the brakes fitted on to the rear wheels. This equipment is operated by hand controllers suitable for series parallel control.

Later, a fleet of six vehicles was added. These were also of the single-deck type, with seating accommodation for 28 passengers, and were fitted with one 35-H.P. electric motor driving on to a worm differential rear axle by a cardan shaft and couplings; both hand and foot brakes are operated on the rear wheels. This equipment is fitted with foot-operated controller, and is arranged for rheostatic braking.

Chassis.—These two types of chassis were each specially designed for trolley omnibuses. As such vehicles are only few in number at the present date, the necessary spare parts cannot be readily obtained; further, the cost of these spares when received is abnormally high, and not until such chassis have done sufficient service to prove the stability of the different units, can the various parts be standardised so that they can be readily obtained and at reasonable prices.

During the two years' running of such chassis it has, in my opinion, been proved that certain units would not stand up to the work with overloads and bad road conditions; therefore it has been necessary to re-design, strengthen up, and have such parts made specially to keep the vehicles serviceable. This has resulted in making the repairs and maintenance costs to cars much higher than they otherwise would have been had these units been designed and built to meet the work required of them. The fitting of two motors in a chassis which was the case with the first type of equipment not only makes the initial cost very high, but also entails a duplication of working parts throughout for maintenance. The fitting of a single motor is a much simpler method. It greatly reduces the initial cost, has less working parts, and also reduces the maintenance costs, which is a factor not to be lost sight of.



The Normanby Terminal Loop.

Referring back to the early days of building railless trolley vehicles, it appears that the designers' idea was to put on the market a vehicle totally different from any other type of transport vehicle. This they certainly accomplished, and by so doing have necessitated a repetition of costly experiments, which omnibus chassis builders had already carried out after considerable expense during many years of running experience "pre-war." During the war period valuable knowledge was further gained by them with regard to

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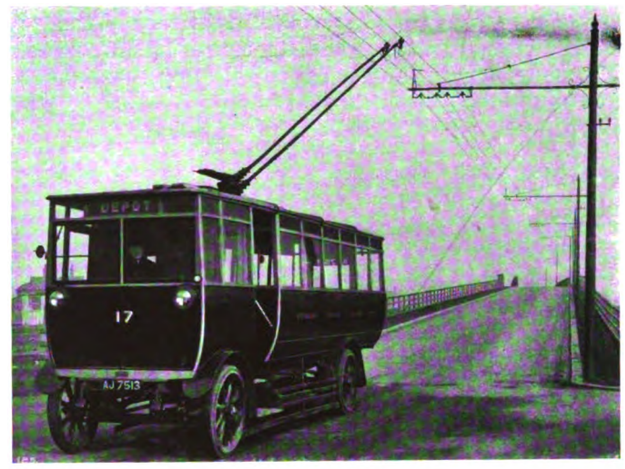
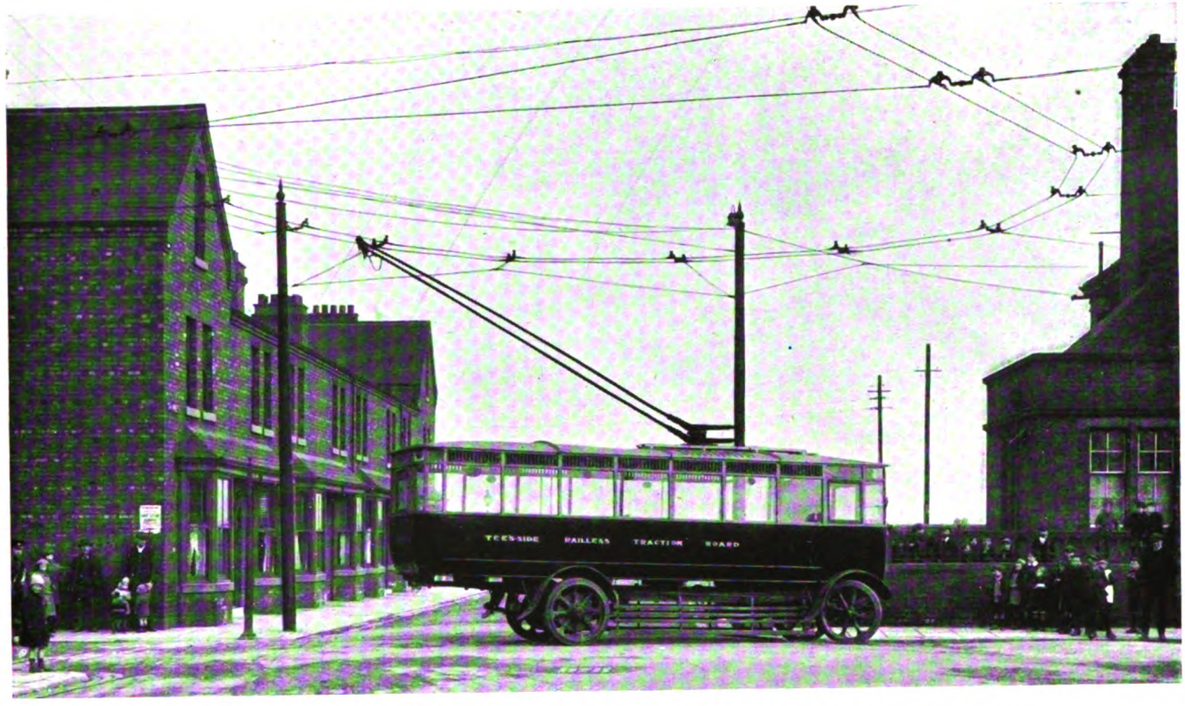
One of the Second Type of Tees-side Trolley Omnibuses.



Latest Type of Tees-side Trolley Omnibus.



Latest Type of Tees-side Trolley Omnibus Rounding the Grangetown Terminal Loop.

One of the Latest Vehicles backed into a Side Street Preparatory to Turning.

The same Vehicle as that Opposite, Turned Round and Drawn up to Kerb. On the Right is an Earlier Type of Omnibus.

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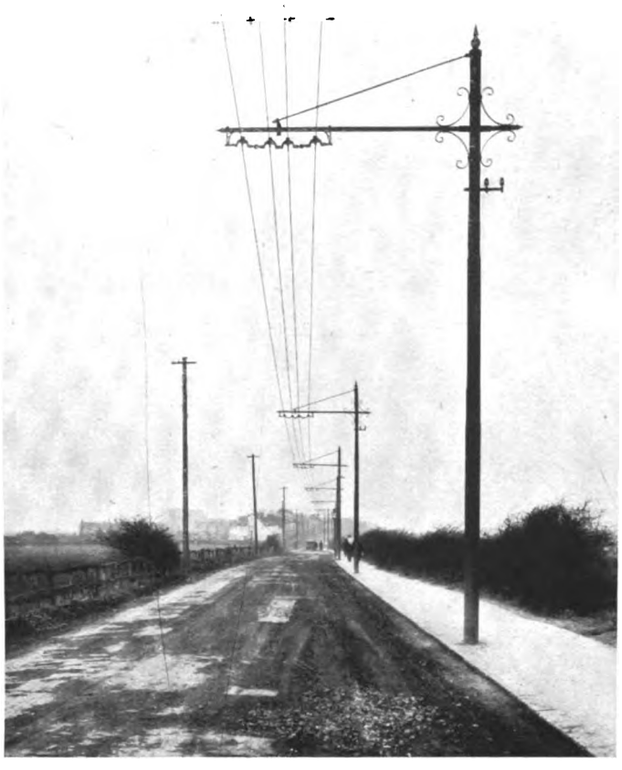
the perfecting of the chassis. It appears to the writer that this valuable and costly experience should be made use of without further experimenting and wastage of money, as the approved petrol type chassis meets the requirements of a trolley omnibus when suitably fitted with reliable electrical equipment.



Overhead Construction, Showing Incidentally the Condition of the Road.

With this in view, and after the experience that has been gained on the maintenance and repairs to the afore-mentioned types of experimental chassis, I at once decided to have a trolley omnibus fitted up embodying all the main features of an approved type of petrol chassis, and fitted with a standard tramcar type of traction motor, and electrical equipment with a view to—

(1) Reducing the initial cost.
(2) Reducing the repairs and maintenance.
(3) Obtaining spare parts readily at reasonable prices.
(4) Longer life with higher efficiency by using a combination of approved type of units.
(5) Greater comfort in riding for the travelling public.

This trolley omnibus has now been completed, and is fitted with a single-deck body to seat 36 passengers, the seats having well sprung cushions and spring seat back rests. The tyres fitted are of the Dunlop super resilient type. These, together with the efficient springing of the chassis, give a most comfortable and desirable effect from a passenger's point of view, and the smooth and quiet running is very noticeable. The results up to the present are very satisfactory. The operating costs on the mileage up to date, viz., 5,000 miles, equals 12·11d. per car-mile, which is made up as follows—

OPERATING COSTS OF NEW TROLLEY OMNIBUS ON 5,000 MILES' RUN UP TO 11TH FEBRUARY 1922.

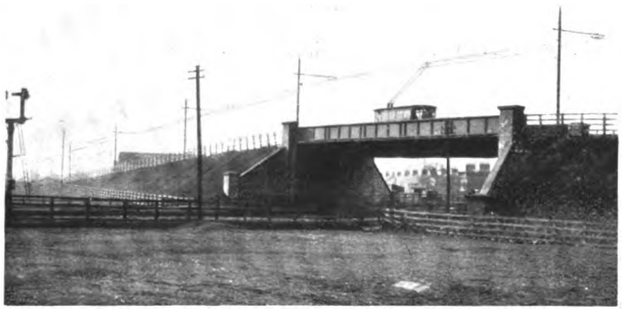
TRAFFIC EXPENSES—	
Wages of motormen and conductors	5·07
Cleaning and oiling	·53
Fuel and light	·05
Ticket check etc.	1·13
Uniforms	·01
Miscellaneous (including licences)	·74
	7·53
GENERAL EXPENSES—	
Salaries	·78
Rents, rates and taxes	·59
Printing and stationery	·21
Fuel, water, etc.	·01
Accident insurance and compensation	·20
Fire and other insurances	·10
Miscellaneous	·25
	2·14
REPAIRS AND MAINTENANCE—	
Bridge	·05
Electrical equipment	·54
Buildings and Fixtures	·06
Cars, including tyre allowance	[illegible]
	1·44
POWER EXPENSES—	
Cost of current at ¾d. per B.O.T. unit	1·00
	12·11

OVERHEAD LINE.

The aggregate length of overhead line is 5 miles 8 chains, and covers three routes as follows—

North Ormesby to South Bank	1·92 miles
South Bank to Normanby	1·77 miles
South Bank to Grangetown	1·4 miles

The installation of the overhead equipment was commenced early in July, 1915, and completed in six months; thus it was erected approximately four years before the service commenced. This, of course, was owing to the war. Tubular steel poles to the British Engineering Standards Committee's specification are employed in three different strengths, light, medium and heavy, and are erected in concrete. The light poles are used on the straight, medium poles at moderate curves, heavy poles at sharp curves and at the terminal loops.



Bridge Over North Eastern Railway (Eston Branch).

Trolley Omnibus on the Approach to Bridge.

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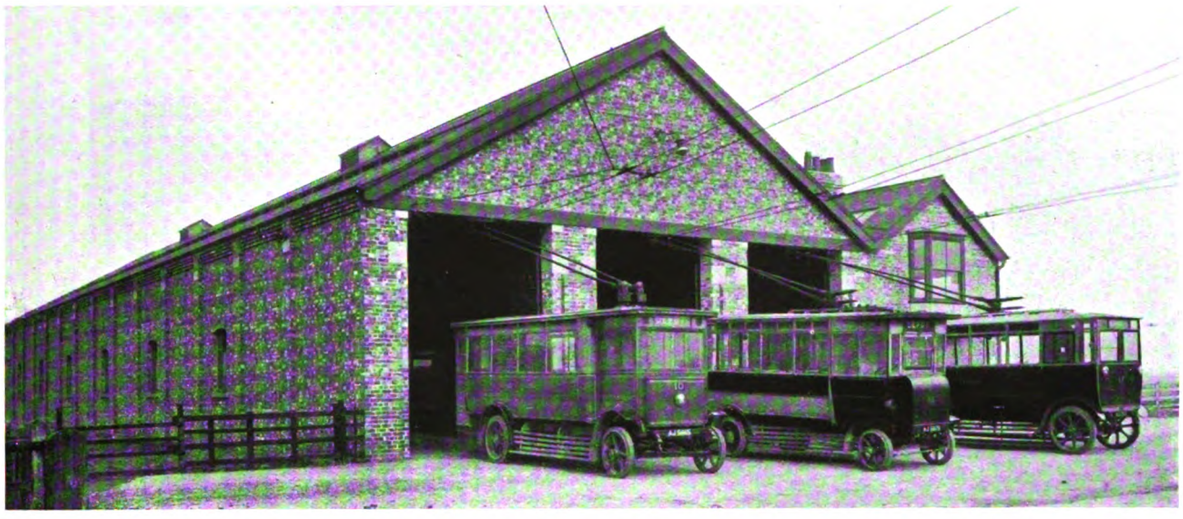
Side bracket arms and standard fittings support the trolley wires. Two pairs of trolley wires are employed throughout the whole route, the negative trolley wires being placed on the outside. The trolley wires are of 3/0 S.W.G. hard drawn copper, so arranged as to allow the omnibuses to work with under running trolleys, and are divided into half-mile sections by section insulators. The positive wires are connected across at these sections by means of insulated cable brought down the inside of the poles to switch boxes attached to the poles, and this enables the switching off of any half mile of the positive wire from the rest of the system. At each terminus the trolley wires are erected in the form of a loop, so that the omnibuses can turn completely round without changing trolleys.

The electrical energy is supplied under an agreement by a local steel works at 550 volts direct current at a cost of ¾d. per unit.



One of each of Three Types of Trolley Omnibuses at Entrance to the Car Shed.

Two ·2 square in. bare overhead feeders are carried *en route*. A telephone system is installed from each terminus to the omnibus depot and power station.

The total repairs and maintenance cost to the overhead equipment since the commencement equals ·54d. per car-mile.

Condition of Roads.

One of the main factors for the efficient and economic running of any railless vehicle—whatever it's propelling unit may be—is a properly designed and well kept road. If this be not the case, the vehicles will soon develop defects which will result in a greatly increased cost of repairs and maintenance. Unfortunately when this undertaking commenced service, some of the roads on the routes covered by the vehicles were in a deplorable condition. Up to the present only about two miles of road surface has had attention, the main portion of which has been laid with stone setts on a concrete foundation. This type of road does not give a very desirable running effect, owing to the numerous sharp vibrations set up on the vehicle, and it has been necessary to apply a top dressing of a thin coat of "Tarmac," which has made running much smoother. The remainder of the routes are still in very bad condition, especially on one section of County Road.

The vehicles therefore have been running under very unfair road conditions, and the majority of defects which have developed are traceable to such conditions. This is one of the chief causes for the costs of the repairs and maintenance of the cars previously referred to being so high, viz., 4·95d. per car-mile. The authorities have realised the seriousness of such conditions, and they intend to commence the making of good roads at an early date. At one portion of the route a bridge has been erected to obviate the level crossing of the North Eastern Railway Company. The cost of this comes in the capital expenditure, and, further, the undertaking is responsible for the repairs and maintenance of this bridge. The cost entailed thereby is included in the figures previously submitted.

In conclusion, it will be seen from the foregoing remarks that the system, up to the present, has been faced with exceptional difficulties. It is anticipated, however, that these will shortly be overcome, enabling the undertaking to become more than self-supporting, while providing a service that will meet all local demands.

THE SCOTTISH TRAMWAYS ASSOCIATION.

The first general meeting of the newly-formed Scottish Tramways Association was held in Glasgow on February 17. Mr. James Dalrymple, general manager of Glasgow Corporation Tramways, presided. Appointments were made to various offices for the ensuing year, and an Executive Committee was formed.

Councillor J. G. Fraser (Dundee) moved that a clause be inserted in the constitution making it permissible for representatives of the tramway employees to be heard on any matter affecting their interests. The motion was defeated, but it was pointed out that one of the purposes of the Association was "to consider and discuss any matters that may be referred to it from time to time," which it was considered would cover this point.

It was remitted to the Executive to consider recommendations regarding working hours and conditions of tramway employees in Scotland in substitution of the March 1919, agreement, in view of the fact that the Scottish "A" area of the Joint Industrial Council would soon cease to exist, owing to the number of resignations which had recently taken place.

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LEEDS TRAMWAY IMPROVEMENTS.

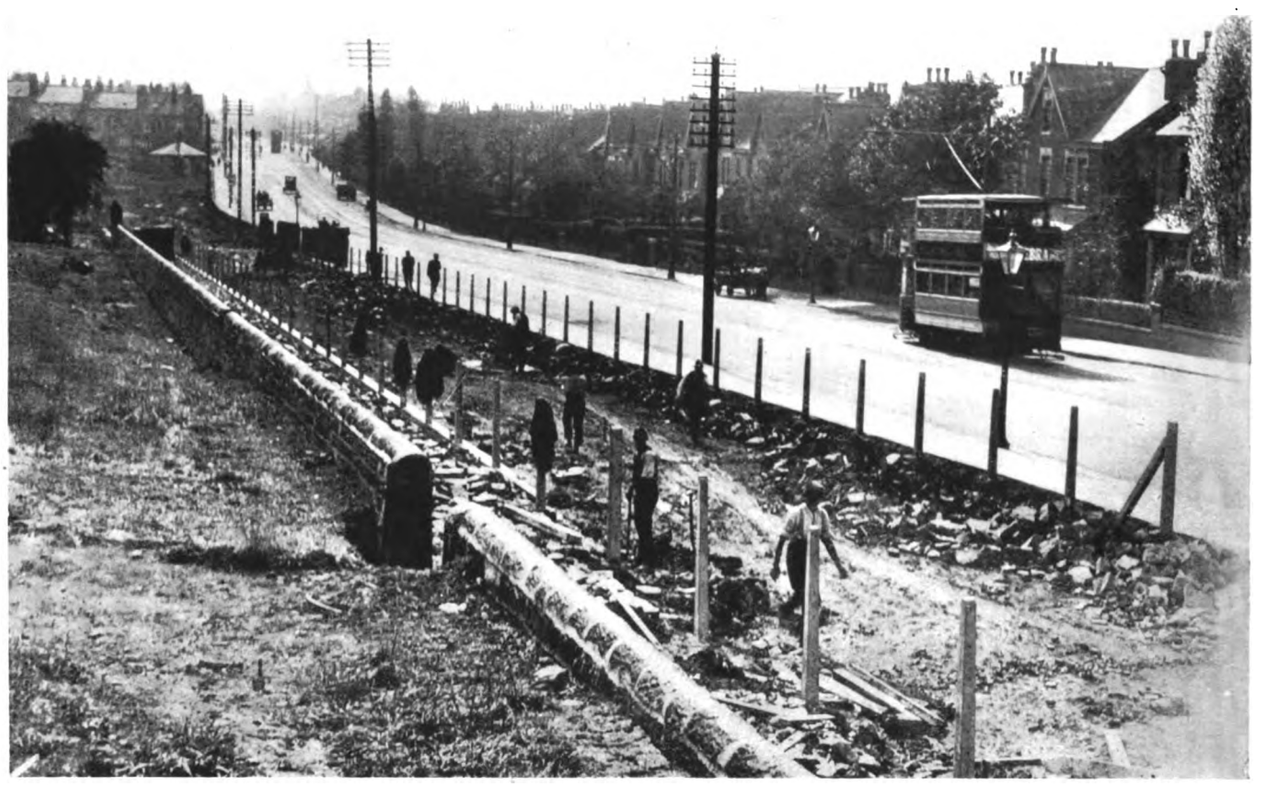
NEW EXPRESS TRACK OF SLEEPER TYPE IN ROUNDHAY ROAD.

Two schemes of road and tramway reorganisation undertaken by the Corporation of Leeds with the object of materially improving communication between the centre of the city and rapidly developing suburbs are now in an advanced stage.

In Roundhay Road the road widening necessary for the laying of a separate tramway track on sleepers has been carried through, and, granted reasonably good weather, the track will be laid and the junctions with the existing track at Harehills Lane and Oakwood made at the end of the present month or at the beginning of April. Ultimately it is intended that the express route shall be continued along Princes Avenue to the gates of Roundhay Park, and work is at present being found for the unemployed in excavating and levelling the land for a width of 25 feet adjoining the highway in Prince's Avenue.

The new Roundhay Road track has its origin in the fact that the existing track badly needed renewal so long ago as 1914. When the question came up for consideration following the war, the cost was regarded as almost prohibitive, and no doubt the Corporation was influenced in adopting the course now taken by the fact that vacant land occupied one side of the road. It was decided to cheapen the cost of construction by taking the tramway from the road and re-laying it on a sleeper track at the side. The track now practically completed is about three-quarters of a mile in length, and has a width of 23 feet. The work has taken well over a year, and one task that had to be undertaken was the setting back of a lodge for a distance of 40 feet.

When the connections are made the superseded length of old track will be taken up, the existing granite setts removed for use elsewhere, and the road made good with tar macadam. A 5-in. tramway rail of 90 lb. to the yard is now being laid on the new track. Reinforced concrete fence posts and wire fencing are being employed to separate the track from the rest of the roadway. It is believed that the express track will ensure not only rapid transit, but economy in first cost and maintenance, reduced noise, and the avoidance of delay to general traffic when lines have to be repaired.



View in Roundhay Road, Leeds, showing Present Tramway Track and Express Track Under Construction.

Roundhay Road is greatly used by motorists, and the possibility of danger through their getting on to the new track at night in consequence of following the tramway lines has been mentioned. Expert opinion is that the danger is mainly imaginary, and that the line of the kerb will provide a sufficient guide. If necessary, however, red lights will be provided at the junction.

"Direct labour" under the control of the Highways and Permanent Ways Department of the Corporation has been responsible for carrying out the scheme.

A route to the Middleton housing area on the south side of the city has been constructed, and a temporary light railway is serving to take building materials to the site of the houses daily, the wagons being drawn

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View showing Completed New Sleeper Track of Leeds Corporation Tramways in Roundhay Road. The Track is shown as under Construction on the opposite page.

Middleton Light Railway under Construction by Leeds Corporation.
The Track is being laid on sleepers, and the Line will serve a New Housing Area.

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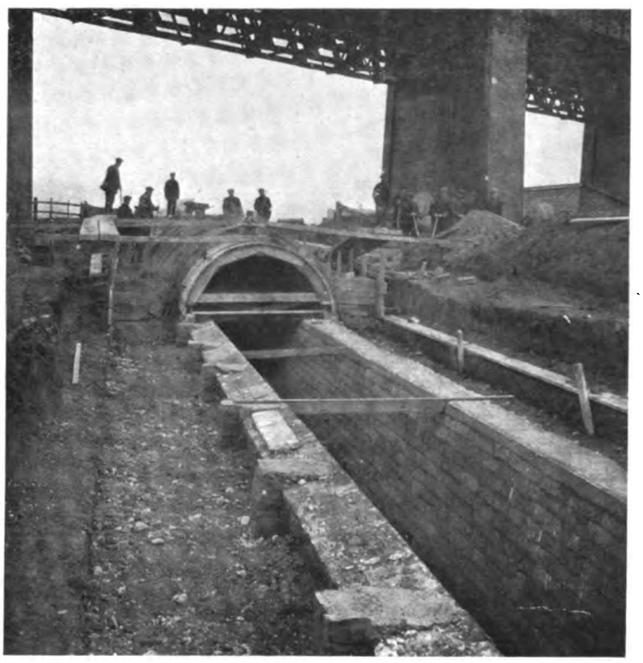
by a steam locomotive. All the formation levelling and embanking has been carried through, and the road pitched in readiness for a sleeper tramway track. When sufficient houses are erected a passenger coach will probably be attached to the locomotive for the convenience of Middleton residents, but it is expected that a year or two will elapse before the electrification of the line will be justified. For the greater part of its length the new track has been laid independently of roads upon land which was purchased from the Middleton Colliery Company at a low price contingent upon the Corporation undertaking to provide a passenger service. About 3·63 miles have been laid, and the track runs for a considerable distance through



Culverting a Stream—Bell Isle Beck—on Middleton Light Railway.

picturesque woods. Simultaneously with the purchase of the necessary land, 316 acres were obtained from the colliery company by the Wade Charity Trustees, who have since handed it to the Leeds Corporation for use as a park for the residents of the district. In the making of the track a good deal of rock had to be excavated, and it was necessary to culvert a stream known as Belle Isle Beck. At the present moment the temporary railway finishes at Hunslet, but it is intended, when the tramway track is laid, to connect up to the existing track in Dewsbury Road, about a quarter of a mile away. As the result of the new transport facilities it is anticipated that Middleton Wood will, in the course of time, become a popular resort for the residents of the congested industrial areas of Hunslet and Holbeck.

The whole of the excavation work of the scheme has been carried through by the local "unemployed," and the track work by direct labour under the control of the Highways and Permanent Ways Department of the Corporation.

Tramway and Railway Through Bookings in London.—The London United Tramways have initiated a scheme of through bookings between certain stage points on their system and important stations on the Underground Railways. This will expedite the handling of traffic at the exchange points by relieving the booking offices at such interchange stations as Hammersmith and Shepherd's Bush during the rush hours.

THE BRILL 79-E SINGLE TRUCK.

Those pioneers in truck design, The J. G. Brill Company, have recently introduced and patented a new type of single truck. Since their well-known "21-E" was produced almost every tramway has operated some, at least, of its cars on this type of truck, and many systems use no other. Notwithstanding the long and successful career of this truck, it has for some time been felt by the makers that the improvements that have been devised to meet changed conditions of operation have now made an entirely new single truck very desirable.

The new 79-E truck departs somewhat radically from the 21-E, and the most noticeable point of difference is in the small diameter of wheel. Heretofore a wheel of 33 in. to 30 in. diameter has been the rule; in this 79-E truck, however, a diameter of 24 in. has been standardised, although 26 in. wheels can be furnished where greater motor clearance is desired. By this basic change other modifications are entailed, the first of which (and a most important one) being the long wheel-base. An 8 ft. wheel-base is the minimum in this new truck. Taking the average 6 ft. wheel-base used on so many systems having sharp curves, there is a clear gain in stability and road worthiness of 2 ft.—an increase of 33⅓ per cent. The same ease of operation on curves is claimed as with the present 6 ft. wheel-base—33 in. wheel combination. Incident to this increased wheel-base is the reduction of car overhang on curves. A lowering of the centre of gravity of the vehicle is a further attribute of the small wheels, a reduction of 4½ in. in overall height being gained thereby. It is suggested that this may make all the difference in fitting top-covers to cars on many systems, at present compelled to lose traffic with open tops, due to low overhead bridges. Yet another factor is the ability to use continuous platforms in place of the heavy and expensive drop platforms necessary with the present wheel diameter. It is pointed out that a continuous platform makes a lighter yet stronger underframing, and gives the same easy step heights as at present. So much for the advantages achieved by the smaller wheel and longer wheel-base.

Coming to the truck proper, a Brill solid-forged steel sidebar, upon which Brill trucks have built their reputation, is incorporated. The absence of a top chord will be noticed. A quarter-elliptic spring is lipped under a projection of the yoke and anchored securely to the short end arm. At the ends of these leaf springs brackets are mounted on coil springs, the whole swinging on a half-ball link attached to the leaf spring. The body is mounted directly on to the brackets, and a unique spring suspension is thus obtained. Firstly, a coil spring for light loads which when compressed brings the heavier load on to the strong quarter-elliptic, thus giving the maximum of comfort in car riding under graduated load conditions. This combination of quarter-elliptic plate and coil springs, joined together by a swing-link element at the four corners of the truck, is claimed to give the easiest riding qualities ever obtained in single truck car operation, over the most uneven road bed. As most of the load is suppported on this four-corner spring arrangement, excessive oscillation of the car body is eliminated. The car body as shown is cushioned on quick-acting coil springs, which absorb the minor shocks and vibrations due to irregularities of the track, and which would otherwise be transmitted to the body

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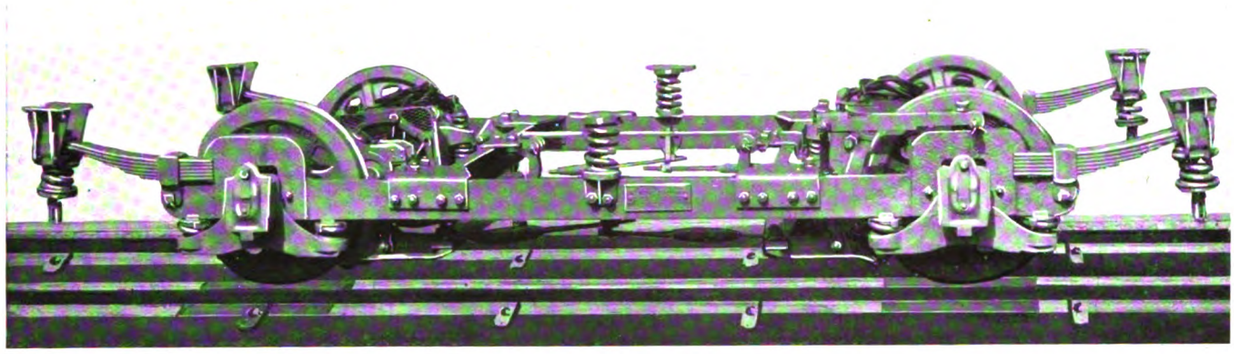
through the slow-acting friction plate springs. The latter are not influenced by minor shocks and jolts, but they damp the action of the coil springs before the car develops an oscillating motion. The four swing-links provide the flexibility required between truck and body to neutralise the objectionable snaking or nosing of the car on bad sections of the track.

Two torque rods or links are mounted on diagonally opposite sides of the truck and connected to the body. These give the necessary rigidity in a longitudinal direction, and relieve the pressure on the journal boxes in starting and stopping. Vertical and lateral motion is also permitted by this device, dampened by friction coil springs to prevent excessive swaying, but giving sufficient lateral motion to provide easement on curves.



The New Brill Single Truck 79-E.

A notable feature of the truck is the inside-hung brake rigging, making the layout more compact, lighter, and with better equalising features, as compared with the usual outside hung brake shoes, on the ordinary single truck.

The principal dimensions of the truck are as follows:

	(Metre)			
Track gauge ...	3 ft. 3⅜ in.	3 ft. 6 in.	4 ft. 0 in.	4 ft. 8½ in.
Centres of side frame holes ...	4 ft. 10⅝ in.	4 ft. 10⅝ in.	5 ft. 4 in.	5 ft. 11⅛ in.
Width over journal boxes... ...	6 ft. 0⅝ in.	6 ft. 0⅝ in.	6 ft. 6 in.	7 ft. 1⅛ in.
Length of axles friction journals	5 ft. 5⅝ in.	5 ft. 5⅝ in.	5 ft. 11 in.	6 ft. 6⅛ in.
Wheel-base ...	8 ft. 0 in.	8 ft. 6 in.	9 ft. 0 in.	—
Total length ...	13 ft. 6 in.	14 ft. 0 in.	14 ft. 6 in.	—
Spring base ...	13 ft. 0 in.	13 ft. 6 in.	14 ft. 0 in.	—

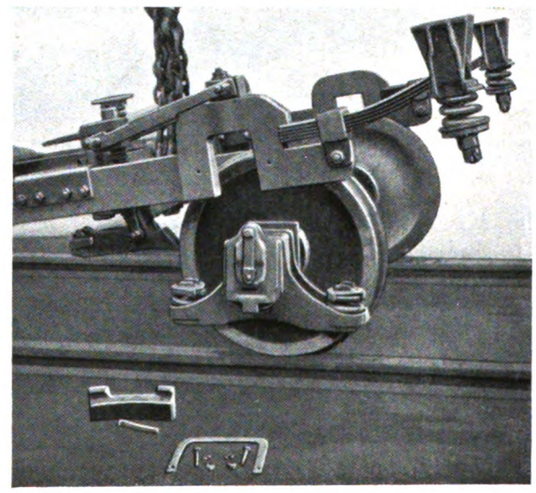
Wheel diameter, 24 in. or 26 in.
Height of truck with empty car body, 23 in. or 24 in.

It has been repeatedly stated that the success of the One-man Safety Car in the United States has been largely due to its riding qualities. If this be true, then its running gear stands revealed as the secret of a success which has revolutionised electric traction in other fields. As this 79-E truck is a more robust edition of the truck now used under 4,000 Birney "safety cars," it has gone well beyond the realms of experiment, and its behaviour during the past six years brings it within the category of proved designs of exceptional merit.

Built on strong rugged lines, this new truck is capable of carrying body and passenger loads equal to those now carried by the Brill 21-E. Lengthening the body, due to the longer wheel-base with the greater passenger capacity resulting, is not encouraged by the makers, but it obviously holds out interesting possibilities. This new Brill truck therefore, fitted with the highly developed light-weight motors (a range of which now obtainable run up to 50 H.P. on 600 volts) presents to tramways managers a striking combination of modern developments in traction matters.

Two strong channels form the crossbars, being secured rigidly to the sidebars by means of the heavy gusset plates bent over and bolted firmly to the side frame. These cross members are placed close to the wheels to give the necessary rigidity to the truck frame, and retain it in alignment. These crossbars also support the brake gear through the medium of half-ball links at the centre of the truck. This brake gear is equipped with the Brill patented half-ball noiseless link device, the half-ball link forgings having a machine fit in glass-hard electric steel castings, the whole kept in correct tension by a spring on a bolt, and thus being automatic in adjustment for wear.

The motor support is carried from a bracket mounted on the crossbar, having upper and lower coil springs. The coil spring shown at the centre of the sidebars is a balancing spring to support the underframe at this point. This will be more clearly understood when it is borne in mind that the car weight is carried mainly on the end springs. The journal boxes are of the Brill standard wide-wing pattern. The small illustration shows the facility with which wheels and axle can be removed from this truck.



Quick Release of Wheels and Axles Effected by Removing Pedestal Strap and Brake Shoes.

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THE WITTON WORKS OF THE G.E.C.

NOTABLE DEVELOPMENTS.

The avowed object of the policy of the directors of the General Electric Company, Limited, has been to develop every branch of electrical work in order that the company should be in a position to manufacture from start to finish, and entirely within its own organisation, the heaviest electrical units commercially possible, together with the necessary switch gear and apparatus, constituting complete installations. The engineering works of the company at Witton, near Birmingham, as they exist to-day, give proof of the steady progress made during the past few years and of the successful endeavour to achieve the position indicated. For many years the Witton works have been known as one of the most important groups of factories in the world engaged in the manufacture of electrical apparatus, and the recent extensions to the heavy engineering departments have increased the resources and capacity of the works to such an extent that they are now able to design and construct electrical machinery and control gear for the complete equipment of power stations, railways, ships, collieries, iron and steel works, etc., and to carry through in their entirety electrical and engineering schemes of any magnitude.

To celebrate the twenty-first anniversary of the commencement of the building of the Witton works, the directors of the General Electric Company recently entertained a number of Press representatives and gave them the opportunity to see for themselves how well equipped the company now is to compete for the world's work. The extensions at Witton comprise seven new buildings—switchgear works, standard motor works, administrative offices, development department, moulded insulation works, enamelling and plating works, and the club house, while the foundry, main engineering works, and small motor works have had several new bays added. Without going into details of the actual area of those extensions, we may say that the works, as a whole, have been rather more than doubled in size, but the greater facilities provided have undoubtedly increased the efficiency of the works by considerably more than this ratio.

Imposing as this group of works undoubtedly is, in order to appreciate fully the extent of the self-contained organisation of the G.E.C., it is necessary to consider the full range of factories and works now included in the company's manufacturing arrangements. In all there are some 20 works, each devoted to specialised production of one or more classes of electrical or mechanical apparatus, and it is in these co-ordinated factories that the strength of the company lies, for they make it possible for the largest contracts to be undertaken, the whole of the plant and apparatus required being manufactured in the company's own workshops.

HEAVY ENGINEERING PLANT.

The most important of the new buildings is that which now forms the main engineering works, where all classes of electrical machinery of the heavy type are constructed. These include turbo-generators, slow-speed generators for reciprocating steam or internal combustion engine drive, rotary converters and large motors for driving many varieties of industrial plant. At the eastern end of the turbo-generator bay, which is separated only by a road from the foundry, the stator castings and rotor forgings are brought in and are there subjected to the necessary milling, boring, turning and slotting operations, for which a range of specially-designed machine tools has been installed. It is worthy of note that the G.E.C. have always made use of the solid rotor for their high-speed alternator, and the success achieved by these machines fully justifies this policy. After the machining is completed, the stator cores are built up, clamped in position and passed to the winding section, together with the rotor, for subsequent assembly, test, and despatch. Fig. 2 shows the rotor of a 7,500 K.V.A. turbo-alternator with the coils being placed in position, and Fig. 3 a rotor for an 8,000 K.V.A. turbo-alternator at a later stage in its manufacture, when the end shrouds are being tightened. Both these rotors are designed to run at a speed of 3,000 revolutions per minute. A

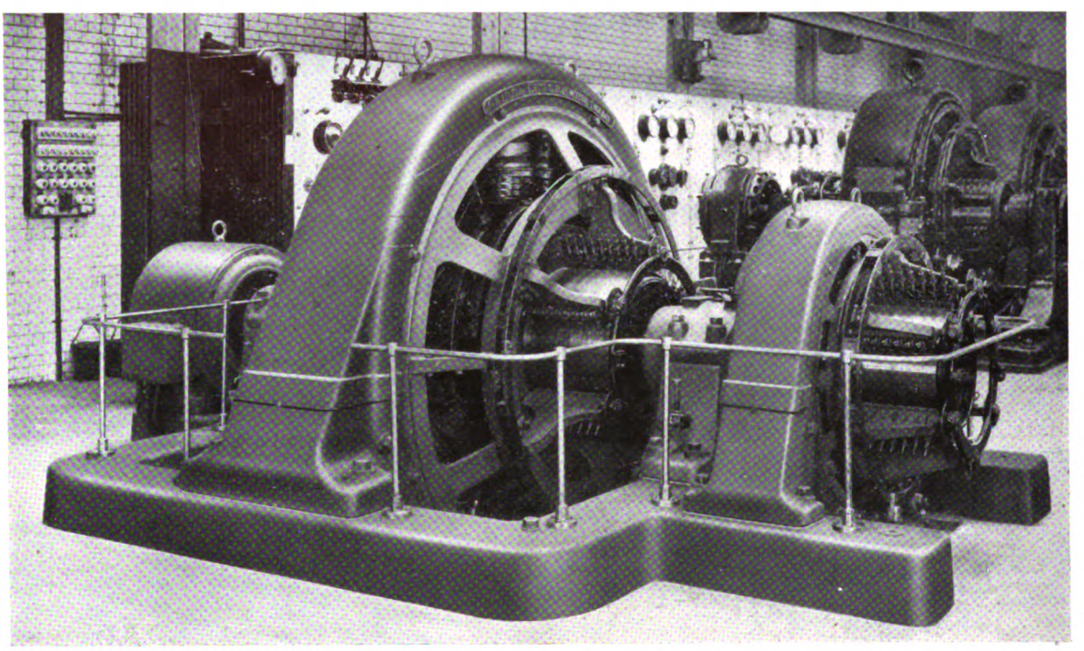

Fig. 1.—1,000-k.w. Rotary Converter for Glasgow Corporation Tramways.

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feature of the G.E.C. turbo-alternators of 6,000 K.V.A. and upwards is that they are all provided with embedded temperature detectors.

Amongst the units seen in various stages of construction were one for the Borough of Marylebone, rated at 10,000 K.V.A., and another for the Bury Corporation, with an output of 12,500 K.V.A., each to run at a speed of 3,000 revolutions. Others noted were two of 6,000 K.V.A. for Guest, Keen and Nettlefold, one of 7,500 K.V.A. for Bolckow, Vaughan and Company, and two of 6,000 K.V.A. for Darlington and Newport Corporations, while three sets each of a rather less capacity were in an advanced state of construction for the City of Pretoria, South Africa, and the City of Auckland, N.Z. Several other units with outputs of from 4,000 to 22,500 K.V.A. were for British Corporations, iron works, collieries, etc. The majority of these were designed to run at a speed of 3,000 revolutions per minute. The three other bays of the main engineering works are equally well situated in relation to the foundry. Two of these are equipped with modern machine tools capable of dealing with heavy parts for large slow-speed generators, rotary converters, induction motors, etc., while the other is devoted to winding, special provision being made for impregnation. Some interesting samples of the G.E.C. rotary converter, which is now widely installed in power houses and sub-stations, were seen. These included four for the City of London Electric Light Company and two for the Charing Cross and West End Company. An important feature in connection with the G.E.C.

Fig. 2.—Rotor of 7,500 k.v.a. Alternator Under Construction.

converter is that with each machine a self-synchronising panel is supplied, which embodies many valuable patents held by the company and for which several important advantages are claimed. The windings of the starting motor are not used as reactances for the main current, and the operations are extremely simple and foolproof. A rotary converter for the British Mannesman Tube Company was of special interest, inasmuch as it had a double commutator, necessitated by the fact that the machine had to deal with a current of 5,000 amperes from the D.C. side. Our illustration, Fig. 1, shows a 1,000 K.W. converter, 480-550 volts, 25 cycles, 600 revolutions per minute, for Glasgow Corporation Tramways.

Large motors, from 500 to 4,000 H.P., for rolling mills in various stages of construction, as well as many other interesting machines, were seen. They included the "Witton" three-phase totally-enclosed motor, capable of rapid dismantling, the "Kapp" phase advancer for power factor improvement and the induction type synchronous motor.

The Witton foundry is believed to be the largest in the Midlands. It is well equipped with cranes, moulding machines, and all the necessary plant for rapid production and ease of manipulation. Each bay is arranged for the production of a special class of casting; the one for heavy castings is equipped to deal with the largest turbo stators, the preparation for such

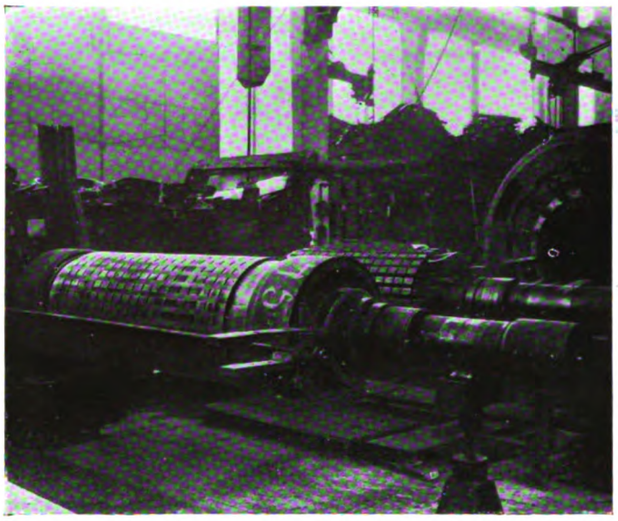

Fig. 3.—Rotor of 8,000 k.v.a. Alternator.

an example being shown in Fig. 4. The metal for this bay is supplied from three cupolas, each capable of melting 25 tons of pig iron per hour. Much use is made of power-operated moulding and jar ramming machines, the largest of which can ram a box of sand, the total weight of which is ten tons. The compressed air plant for operating the foundry machinery is housed in a separate building.

Switchgear Works.

An idea of the importance of the switchgear department of the Witton works will be gathered from the fact that the new building devoted to the manufacture of this class of plant covers an area of 100,000 sq. feet. The building is admirably situated and planned for the rapid progress of work through the shops. It is equipped with the latest tools and appliances and contains many novel features in its lay-out. A fully equipped test department is situated at the end of the works at right angles to the bays, where pressure is available up to 100,000 volts. Switchgear manufactured in these works ranges from starters and controllers to the heaviest types of oil circuit-breakers up to 33,000 volts. Much of the work in progress was for the control of the machines seen under construction in the main engineering works. A main switchboard, drum controller, contactor panels and other items were all part of the same contract as the large D.C. rolling mill motors, while a large 220 volt D.C. switchboard was in the same contract as the 1,000 KW. rotary converter under construction for the Sunderland Corporation sub-station. In this connection it is worthy of remark that the G.E.C. have already supplied to this Corporation a 10,000 K.V.A. turbo-alternator, two 1,500 KW. motor generator sets with

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"Kapp" phase advancers and various other items of switchgear.

An important contract now being carried out in these shops is for the complete equipment of a special switchgear house for the Metropolitan Railway, for which many items were on view. The main section of this contract calls for 11,000 volt gear to control one 12,000 K.V.A. alternator, five 5,000 K.V.A. alternators and 15 outgoing 300 ampere feeders. The switchgear house is to be constructed in three storeys, the bus-bar chambers on the top floor, oil switches in the middle, and instrument transformers below. All the switches are to be electrically remote controlled

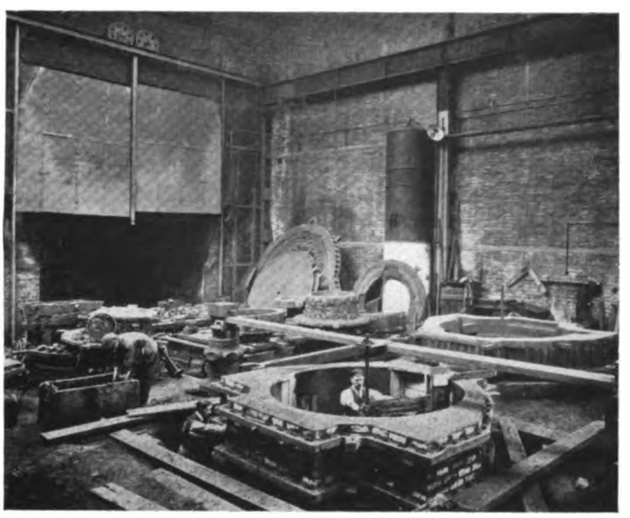

Fig. 4 —Preparation for Casting a 15,000 k.v.a. Turbo Stator.

from special operating panels on the third floor. The high tension gear will be in brick cubicles, the oil switches having a breaking capacity of 350,000 K.V.A. Oil switchgear of the higher voltage type was seen in course of construction for controlling 33,000 volt apparatus to be installed in South Wales. This is similar to a number of sets recently supplied to a South American mining company for use on a similar circuit, but with a braking capacity of 800,000 K.V.A. Several examples of the truck type cubicle switchboard were being erected. This is built in sizes suitable for voltages up to 11,000. An illustration of a board just completed for the Bloemfontein Municipality is shown in Fig. 5. Other interesting types of switchgear included oil-immersed rotor starters, oil-immersed drum controllers and oil switches of various patterns.

A special type of panel which attracted attention was that for testing the apparatus of the G.E.C. biassed differential system of protection (McColl's patents). It is claimed for this system that it makes possible a degree of sensitivity not attainable with any other protective system. Many other lines of ironclad switchgear suitable for all standard voltages were seen, as well as a large number of fuse boards, motor starters, drum type controllers, contactor gear and other standard lines with which the name of the G.E.C. is familiarly associated.

Standard and Small Motors.

Two large works, quite distinct from the main engineering works, are devoted to the manufacture of electrical machines other than those of 500 H.P. and upwards. The standard motor works has been specially equipped with a view to the rapid production of standard units from 10 H.P. to about 500 H.P., all special machines being constructed in the main works. The works are laid out in three principal bays, with a large rough casting store running the full width of the works at the foundry end. The outside bays are for winding and machining respectively, the various parts flowing into the centre bay for assembly, test and dispatch. The small motor works is reserved for fractional horse-power motors and small motors and generators up to 10 H.P. In each of these works the grouping of machine tools and the general lay-out has been so arranged that handling of parts is reduced to a minimum, while the use of jigs and templates not only makes for rapid production but a degree of accuracy which ensures interchangeability of parts. Buffing, plating, enamelling and other necessary but subsidiary processes are carried out in shops specially designed for these purposes, with due regard to the health and well-being of the operators. All enamelling operations are done by compressed air, both in these shops and those attached to the switchgear works.

Development and Research.

The G.E.C. central research laboratory was founded some years ago at Wembley and is to-day a highly developed organisation for scientific research, which undertakes the investigation of the more abstruse manufacturing problems encountered by the various associated factories. At each of these works, however, a development department has been established, which, working in conjunction with the central laboratory, is able to ensure that every new departure shall be based upon careful experiments carried out in its own development department. This department at Witton, with its electrical and magnetic testing section, its mechanical test, chemical laboratory and roomy workshops were all open for the visitors' inspection. Each section is equipped with the latest scientific apparatus, pressures up to 50,000 volts being available.

Social and Welfare Work.

No description of Witton works can be complete without reference to the excellent care which has been taken to provide for the well being of the workers in every department. The system of lighting, heating, ventilation and sanitary arrangements is such that at all

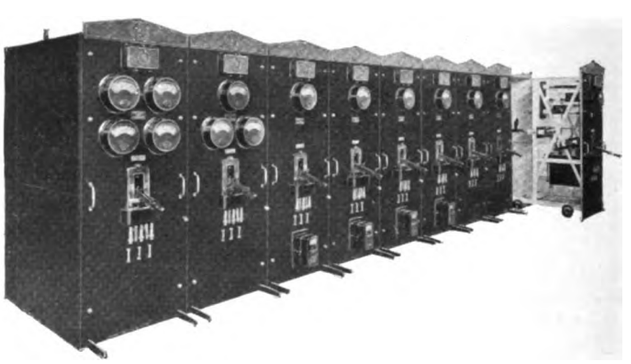

Fig. 5.—Truck-type Cubicle Switchboard—Bloemfontein Municipality.

seasons of the year the conditions under which the work is carried on are wholly admirable. As a memorial to the many who left Witton to take part in the Great War and did not return, the company has erected a magnificent new club house and laid out playing fields covering many acres. These are fully utilised by the workpeople during their meal times and leisure hours.

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ENGLISH ELECTRIC ROTARY CONVERTERS.

At the present period, when British manufacturers of electrical engineering plant have to contend with foreign competition which is aided by the post-war economic conditions, a brief account of one branch of the operations of the English Electric Company will be of interest. The description will also be useful as a reminder to municipal authorities and others of the enterprise which the English Electric Company, Limited, have shown by laying themselves open to supply every electrical engineering requirement of importance.

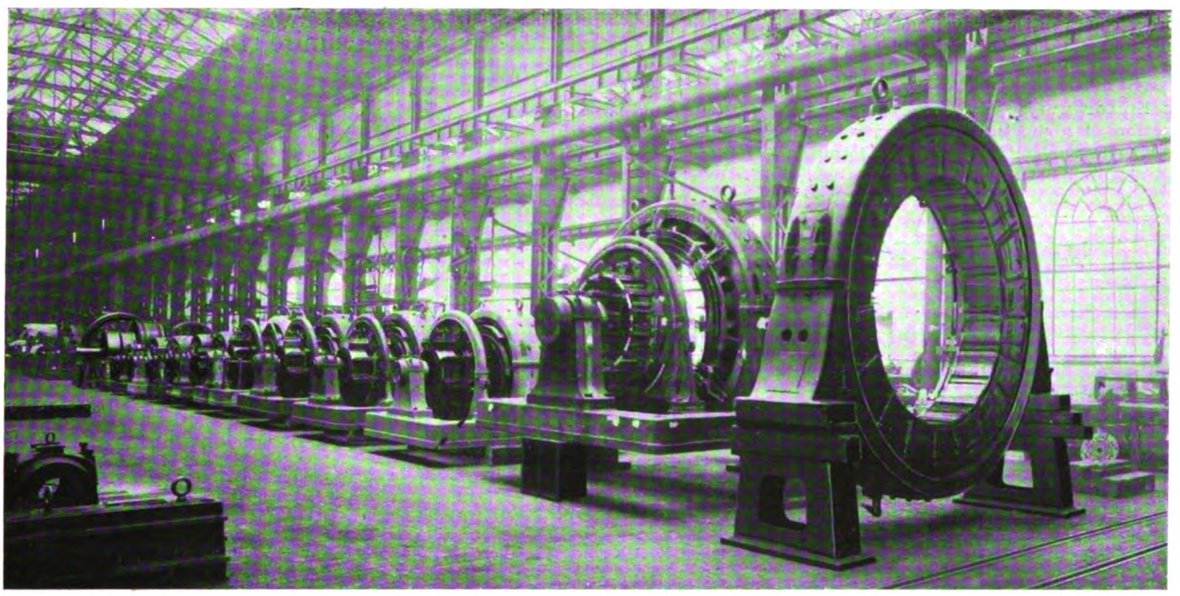
The illustration on this page shows a number of rotary converters in various stages of construction at the Stafford works of the English Electric Company, Limited. The frame on the right-hand side of the picture belongs to a very heavy current low voltage machine designed to give a direct current supply for rolling mill work. The armature belonging to it may be seen at the extreme left-hand side of the picture. This is designed to carry about 6,000 amps., and the special double commutator construction can be clearly seen.

Next to the frame of this machine are a number of parts of a 1,500-KW. machine for municipal service, designed to run at 428 revolutions per minute. Still proceeding to the left there will be seen machines of 1,100 KW., 1,000 KW., 500 KW., 250 KW., and 200 KW.

In addition to the above, four or five more machines were running on the test bed at the time, varying in output from 1,500 KW. down to 200 KW., and the modifications in design between the largest and the smallest sizes of some 15 machines dependent upon the conditions of service and the frequency of the alternating current supply form a most interesting and attractive study.

We understand that the English Electric Company intend to build all their rotary converters for industrial or municipal service at the Siemens Works, Stafford, which are exceptionally well laid out to deal with a wide range of machines, suitable for the varying conditions of periodicity and voltage met with in general municipal and industrial service.

Another part of the same works is devoted to the manufacture of the whole of the A.C. and D.C. switchgear necessary to control the rotary converters, while the step-down transformers for working in conjunction with the converters are manufactured by the same company at their Coventry works, so that the English Electric Company are in a position to furnish the entire equipment of a rotary converter sub-station from the products of their own factories.



Stages of Rotary Converter Construction at the E.E.C. Works at Stafford.

PASSING TRAMCARS IN LONDON.

Mr. Neal, in the House of Commons on February 25, said he had received representations from the London County Council as to the danger of other traffic passing tramcars which have stopped for the purpose of landing or embarking passengers at regular stopping places fixed by the police for these purposes, and it had been suggested that a regulation should be made requiring vehicles passing on the near side of a stationary tramcar to slow down while doing so. It was doubtful whether the Ministry of Transport had power to make such a regulation, and in any case it seemed undesirable to do so. It would be difficult to enforce it effectively in view of the large number of tramcar stopping places.

Sir H. Brittain inquired whether, seeing that the suggested rule was being carried out throughout the whole of the British Empire and the United States, it should be difficult to enforce it in London. Mr. Neal replied that the police had a very clear view that it would lead to more accidents than it would prevent, and there was, moreover, great doubt whether there was any legal authority in the Ministry to interfere.

Sir F. Hall asked whether Mr. Neal remembered that he sat on the Select Committee with regard to the case of the general condition of London traffic, and did he propose to take any steps to carry out the suggestions of the report of that committee? Mr. Neal replied that as to the Select Committee presided over by the late Mr. Kennedy Jones, M.P., it had not been found possible to bring its recommendations into operation. They would need legislation, and he thought the whole question of dealing with London traffic was inextricably mixed up with questions of local government in London.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, MARCH 16, 1922.

The Brighton Railway Electrification.

The London, Brighton and South Coast Railway Company have again had to postpone their scheme for electrifying the main line from London to Brighton, but they intend to go on as circumstances permit with the conversion of their suburban lines. They have abandoned the promotion of a Bill in Parliament to authorise the raising of a loan for electrification, because there were objections from existing stockholders. At the annual meeting the chairman, Mr. C. C. Macrae, said that the board had determined that until the times became more favourable for raising capital the extension of electrification will be confined to those sections of the suburban system where the needs are greatest. If the company, he stated, were independent they could go ahead vigorously with the work, but the Railways Act of 1921 has a paralysing effect on independent action. Under that Act the company is to be amalgamated with the South Eastern and Chatham and the London and South Western Companies. In negotiations for that end they were confronted with the contention that no electrification work involving large expenditure should be undertaken by any one of them without the consent and approval of the others. As the companies use different systems, that is a bar. He hoped the Government Committee on the subject would be able to report on the steps it may be advisable to take on the several electrification schemes they have in contemplation, and to suggest a solution of the deadlock. It will thus be seen that the position, so far as the Brighton company is concerned, is pretty much one of "as you were."

South Eastern Railway Electrification.

It is never safe to prophesy, but it is quite safe to say that there is a good prospect of the electrification of the suburban lines of the South Eastern and Chatham Railway being begun before long. A definite statement was made by Mr. Cosmo Bonsor, the chairman, at the annual meeting of the two associated companies. It has been said that the two companies do not possess Parliamentary authority to use electric traction, but the delay which would arise before such powers could be obtained is to be prevented. The Ministry of Transport have powers to make orders for the development of railways, and we are informed that some time ago the Ministry granted an Order for this electrification scheme, the work to be carried out and the equipment for the time being to be owned by a construction company. The South Eastern and Chatham Railway lost its once splendid suburban passenger traffic owing to the competition of electric tramways and motor omnibuses, and the latter are now threatening some of its traffic beyond the London suburbs. To meet that, and to win back lost traffic, electrification is necessary. It was the passing by Parliament of the Trade Facilities Act last autumn which gave the two companies an opportunity. They applied for a Government guarantee under the Act of principal and interest of new capital to be raised for the work, and Mr. Cosmo Bonsor stated that the application met with very favourable consideration. It appears, however, that at the time when the chairman spoke a final decision had not been arrived at by the Government, nor had it at the time when these notes were written, because in the House of Commons on March 6, Mr. Neal, Parliamentary Secretary to the Ministry of

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Transport, stated in reply to a question that the Advisory Committee under the Act had applications for guarantees from the South Eastern and Chatham and the London electric railway companies under consideration. It is apparent, however, from the tone of Mr. Bonsor's speech, that he had no doubt the result would be favourable, and it is much to be desired that it should be so, for the gain both to the companies and the public would be very great.

The Construction Company.

Mr. Bonsor stated that a private construction limited company will be formed with borrowing powers sufficient to cover the cost of construction, the money borrowed to carry the Government guarantee, and it will thus be obtained on the most favourable terms. The works will be the property of the construction company, and will be leased to the South Eastern and Chatham Railway for 25 years at a rent sufficient to repay the capital and interest at the expiration of the lease, when the works will become the property of the two railway companies. Mr. Bonsor considers that the opportunity is unique, the arrangement good, and the figures as to results are estimated to be extraordinary. Taking the present level of fares and a very moderate increase in the number of passengers, with a certain ascertained decrease in working expenses, the directors estimate that in the second year of working there will be a good margin of profit. There seems to be justification for these rosy views, especially when it is remembered that this railway has a number of stations in the centre of London, giving a wide choice to passengers. The fast and frequent service of electric trains will do the rest. The two companies may be congratulated also on the ingenuity of their scheme, which in the long run, if things go as expected, will leave them with the electrical equipment of their lines free from any capital liability. It may be recalled that it is proposed to use the high-tension direct-current system of traction, and this will be the largest installation of the kind in the country. It remains to be seen what proposals may be put forward by the Government Committee of experts which is considering the question of co-ordinated electrical working with the London and Brighton Company, which uses single-phase current.

Light Car Era in America.

In the United States the light car—a vehicle distinct from the safety car—is being successfully used on inter-urban lines not only for the reduction of working expenses but for meeting motor omnibus competition. Several instances were brought to the attention of the annual convention of the Central Electric Railway Association held recently at Indianapolis. One of the examples was that of the Northern Ohio Traction Company, which serves a closely built up territory, more than half of the 18 miles of single track running through city streets and suburban districts where high speed is not permissible. There is one 12 per cent. grade about 2,200 feet long, and many easier gradients with numerous curves. The 62,000 lb. cars, equipped with G.E.-57 motors and K-34D control, were replaced by centre entrance cars, having 26 in. wheels, and weighing 41,900 lb., with a seating capacity of 54, as against 46 in the discarded type. The reduction in the wheel diameter from 36 in. to 26 in., taken in conjunction with the correspondingly smaller bolsters and trucks, resulted in a reduction in the height of car floors of 14 inches, thus making it much easier and therefore quicker for passengers to enter. The centre entrance gives a saving in the length of time required for stops, passengers being able to enter and leave simultaneously. The control is interlocked with the doors, and door signals only are used in starting. These arrangements reduced step accidents to the minimum, thus effecting a great saving. Unlike the old stock the new cars were equipped for multiple-unit train operation, with quadruple Westinghouse 532-A motors of 50 H.P. each and H.L. control. The grades prevent the use of trailers. Summarised, the annual saving of operating expenses is as follows—Energy consumption, 18,578 dollars; maintenance of car equipment, 19,658 dollars; maintenance of track, 6,770 dollars; reduction of crew expense by train operation, 2,422 dollars; total annual saving, 47,428 dollars. The outlay for the fifteen new cars at 15,109 dollars each was 226,635 dollars, thus showing a return on the investment of 19·36 per cent. The railway on which the light cars were run was described as the only one of the undertaking on which " the earnings have maintained a straight line across

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the chasm of business depression that has swept Northern Ohio during the last eighteen months." Another consideration is that the cars prevented diversion of traffic to a motor omnibus service which parallels the line the entire distance. The omnibus question was sensibly treated at the conference by President Blinn, who remarked that densely populated, outlying districts, having no electric railways, could be admirably served by omnibus for the time being. If people desired or demanded omnibus transport, he said, "our companies should be the ones to furnish it, because we are primarily in the transportation business."

London Underground Railways.

The annual meetings of the Underground Electric Railways Company and its associated companies, which have been held recently, were particularly encouraging. All-round increases in net revenue were reported, and in most cases higher dividends than usual were declared. In some cases the dividends were the highest on record. Perhaps the most noticeable announcement was the declaration of a dividend of 1 per cent. on the ordinary stock of the Metropolitan District Railway. During the whole existence of the District Railway Company this stock has received a dividend on only five previous occasions, the highest rate being $1\frac{1}{8}$ per cent. in 1880. The last distribution—and it was only fractional—was in 1882. Lord Ashfield, the chairman of the company, told the shareholders that the dividend was practically paid out of the proceeds of the second half of 1921, the distribution of the common fund of the associated companies having been revised as from July 1 of last year. It may be asserted, however, that the increased prosperity of all the companies had its share in the result. As to the causes of the improved position of all the companies, they may be summarised in the phrase higher fares and decreased working expenses. The latter are due to falling wages. The lower cost of materials has not yet had time to produce much effect, owing to stocks bought at higher prices not being yet exhausted. It should be noticed that the improved position has come about in spite of a considerable decrease in the number of passengers. That falling off is not attributed to the higher fares—these fares are still lower than those on British railways generally—but to the great trade depression. The prospects for the current year are very fair; if and when trade begins really to revive they should be good. The chairman has since given some indications of the nature of his new proposals to the Government for improving the railways. The result of that application will, it is understood, be satisfactory, and it will lead to the employment of twenty thousand men over a period of two years. The Government are expected to guarantee interest and principal to the extent of £5,000,000 and to allow the companies to pay interest during construction of new tunnels.

CORRESPONDENCE.

RAIL CORRUGATION.

To the Editor of "THE TRAMWAY AND RAILWAY WORLD."

Sir,—Mr. Harvey's letter in your February issue deals with a subject in which I am more than usually interested. I agree with his remarks in reference to the report of the M.T.A. Committee on Rail Corrugation, but differ with him when he suggests that the "root cause" of corrugation is inherent in the rail. Such a theory would not cover by any means the vagaries of the trouble, and it has, I believe, been investigated in the past with negative results.

When the question is finally settled I think that the cause put forward by me in an article you were good enough to publish in your issue for August 1918, will be found to be correct. This is based on a piratic law of friction, namely, that the coefficient between the wheel and the rail varies with the vibration of the rail.

Briefly explained my argument is that where the rail is held to the foundation in such a manner that its rigidity along its length is not constant, and the natural vibration of the rail thus rendered uneven, then the biting force between the rail and wheel is a varying factor. The momentum of the wheels prevent any variation in the speed, but the tendency for them to bite better and then to skid would be there, and my contention is that this is manifested in the corrugation, the pitch length being a function of the diameter of the wheel.

In practice the variation in the rigidity of the rail may be brought about in different ways; for instance, where the packing under the rail is not uniformly firm, or where the paving varies in its tightness against the rail. But the most acute variation occurs, and also the most quickly developed corrugation, on modern track where the rails are held rigidly to transverse metal sleepers every seven or eight feet, and the joints anchored to girder sole plates. On the other hand, where the rails are laid in such a manner that the resiliency of the bed is uniform, and the natural vibration of the rail thus uninterrupted, corrugation does not occur. The greatest example of this is on our railways, where the trouble is practically absent.

Since the article I refer to was written, to take the matter a little beyond the purely theoretical stage,

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I carried out experiments on a model circular track 4 feet in diameter with rails made from $\frac{7}{8} \times 3\text{-}16$ in. mild steel, bright drawn. The foundation was of concrete, and in the centre a $\frac{3}{4}$ H.P. motor was mounted on a turntable. A horizontal shaft extended to the rail and carried a 6-in. case-hardened wheel, the speed of the motor being reduced by gearing. In the first experiment the rails were put down so as to get a sharp variation in their ridigity, being clamped every 7 inches to bolts let into the concrete, and every second joint resting on a solid bed, the remainder of the rail being quite free. The machine was kept running for three weeks, and in the course of the first few days corrugation began to develop at exactly the points anticipated and these gradually extended until a good part of the surface was covered, the pitch length of the corrugation being approximately 3-16 in. In the second experiment rails were used from the same bars of mild steel, but instead of being clamped to the concrete bed wood blocks were interposed between, and the resiliency of the bed made as uniform as possible. The machine was kept running for fully six weeks, but no corrugation developed. This, I think, is proof that there is something in the theory advanced. If these corrugated rails would interest you I would be pleased to forward them for your inspection.

Yours, etc.

Birmingham. H. M. DUDGEON.

To the Editor of "THE TRAMWAY AND RAILWAY WORLD."

Sir,—I am not writing to criticise Mr. Harvey's letter which appeared in your February issue, but I feel with regard to this subject that the more experience I have with it the less inclined I am to dogmatise.

I am writing, however, to call attention to a very interesting theory brought forward by Mr. Dudgeon in an article published in the August, 1918, number of THE TRAMWAY AND RAILWAY WORLD.

It seems to me that this article did not receive the attention it deserved. Mr. Dudgeon's statement was as follows—

(1) The adhesive force of the rail varies at different parts of the surface owing to the interruption and reflection of the vibration. Where this variation is very acute, and the momentum of the wheel is too great to allow the velocity to adjust itself to it, the surface of the rail is eroded unevenly and the result is corrugation.

(2) If a wheel rolling on a rail for any reason wanted to bite better or to slip, and it had any choice, it would do so at the points of least resistance. A variation in the adhesive force of the rail, due to the interruption and reflection of the vibration in it, would set up such points, and result in corrugations.

I take it that Mr. Dudgeon will agree that the variation in the coefficient of friction from any cause would produce similar results to a variation caused by the interruption and reflection of rail vibration. I have come across nothing in practice to refute Mr. Dudgeon's theory, and, what is more, all cases of corrugation I have met with tend to show the theory to be a correct one. The following are a few instances—

(1) A track laid in 1901 has corrugations scrubbed out many times with increasing periods between the scrubbings. Last scrubbed in 1915, and only now reappearing very slightly.

(2) The type of wheel changed from chilled iron to steel tyred. Corrugations appearing less quickly with a tyre having a better coefficient of friction.

(3) On a track laid without anchors, slight corrugations have been known to appear soon after construction, and when scrubbed out these corrugations have not reappeared.

(4) I believe there is a tendency for high tensile steel rails with a less stable web and greater "whippyness" to corrugate before ordinary Bessemer rails.

I have no doubt that your readers could bring forward many actual and peculiar instances of corrugation, which would be very useful data to tabulate in connection with this important and expensive disease.

Yours faithfully,

C. OWEN SILVERS.

Wolverhampton Corporation Tramways
Cleveland Road,
Wolverhampton, March 3, 1922.

To the Editor of "THE TRAMWAY AND RAILWAY WORLD."

Sir,—I read with interest the letters from Mr. Harvey, of Ilford Tramways Department. I am very humble, and like to take a back seat on rail corrugation discussions, but I feel compelled to give an experience which may astonish many people.

Last summer we were putting in an extra loop on a single line 2 furlongs 5 chains from a terminus. We bonded across the break, and kept a *new* car on the terminus side. Owing to bad weather the construction of the loop was delayed, and the same car was therefore running up and down from terminus to the break for several weeks.

All I wish to point out is the indisputable fact that a large portion of this quarter-mile of track was *very badly* corrugated when the single car (which had been newly delivered from the maker's works) started to run. Before the loop was completed, however, *not a sign of corrugation could be observed* on this short length of track!

Yours faithfully,

A. J. ABRAHAM,
General Manager.

Aberdare Urban District Council,
Electricity and Tramways Department,
Aberdare, February 25, 1922.

FORTHCOMING TRAMWAY CONGRESSES.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

Particulars are given in the Journal of the Tramways and Light Railways Association for February of the arrangements for the annual congress of the Association, which will be held at Bournemouth. The date has now been fixed for Thursday and Friday, June 22 and 23. Papers to be read include one on "Bournemouth Corporation Tramways," by Mr. I. Bulfin, general manager; "Railless Traction," by Mr. E. M. Munro; and "Modern Improvements in Tramway Rolling Stock," by Mr. C. J. Spencer.

As this is the first congress to be held under pre-war conditions since the congress at Newcastle in July 1914, it is anticipated there will be a large attendance. The Mayor of Bournemouth and the Tramways Committee, who have invited the Association to hold their congress at Bournemouth, have placed a suitable hall at their disposal for the business meetings, either at the Town Hall or at the Municipal College. The Mayor and Corporation will entertain the members at luncheon on either Thursday or Friday, and the Association's annual dinner will be held on the other evening.

MUNICIPAL TRAMWAYS ASSOCIATION.

The summer meeting of the Managers' Section will be held at Glasgow on Thursday, June 15, and Friday, June 16. The annual conference will be held at Newcastle-on-Tyne on September 13, 14 and 15.

Tramway System for Peking.—The *Times of India* of February 10 says it is expected that the new Peking Tramways Company will begin the construction of its track "early next spring," entirely with Chinese capital. The Peking municipality and the company have come to the conclusion it is unnecessary to order the demolition of the whole city wall. Only a certain portion of the inner city wall will be demolished. The capital of four million dollars has been fully subscribed by the Government and the Chinese Bankers' Association.

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NEW TRAMWAY AGREEMENT.

FULL TERMS DECIDED BY JOINT INDUSTRIAL COUNCIL.

An important revision of the Tramway Agreement of March, 1919, was effected at an adjourned meeting of the National Joint Industrial Council for the Tramway Industry, held at Montagu House, London, S.W., on Thursday, March 9. The official "record of proceedings," which we publish below, recalls briefly at the outset that at the previous special meeting of the Council held on Friday, March 3, proposals submitted by the employers' representatives for a new Agreement were considered. After sitting from 11 a.m. to 5.30 p.m., the meeting was adjourned until March 9.

RECORD OF PROCEEDINGS OF ADJOURNED SPECIAL MEETING OF THE COUNCIL ON MARCH 9, 1922.

Alderman Wylie presided and those present were –

Sir John Timpson, K.B.E., Aldermen Brown, Craddock, Higham, Messrs. Baker, Bond, Edwardes, England, Fearnley, Goodyer, Rossdale, Spencer, Stokes, Verdon-Smith, Young, and Tegetmeir.

Messrs. Bevin, Black, Baggott, Brown, Clay, Clode, Dunnicliffe, Friend, Ford, Freeman, Graham, Kerr, King, Kershaw, Skinner, Sugden, Tilling, and Trustrum.

Messrs. J. Beckett, J. Cliff, and A de Turckheim (joint secretaries); Mr. Chapman (Ministry of Labour).

Messages of regret for non-attendance were received from Messrs. Howley, McLean, and Bradwell.

The Council resumed consideration of the Draft Agreement, and after the remaining points at issue had been discussed, it was unanimously resolved—

"That the revision of the Agreement of March, 1919 (set forth herewith) be adopted, subject to the approval of the constituent employers and employees."

AGREEMENT MADE BETWEEN THE REPRESENTATIVES OF THE EMPLOYERS AND EMPLOYEES ON THE NATIONAL JOINT INDUSTRIAL COUNCIL FOR THE TRAMWAY INDUSTRY, TO REGULATE THE HOURS OF LABOUR AND CONDITIONS OF SERVICE OF THE EMPLOYEES ON THE OPERATING AND MAINTENANCE STAFFS IN THE TRAMWAY INDUSTRY.

CLAUSE 1.—HOURS OF WORK.

(*a*) The Average Duties Schedule shall be 48 hours per week of six days, including signing on and signing off, over such period as may be agreed locally, subject to the period not exceeding a maximum of three months.

No schedule of weekly duty shall be less than 44 hours, nor more than 52 hours. No schedule of daily duty shall be less than six hours, nor more than ten hours.

(*b*) Duty Schedules shall be posted, on which the Rest Days shall be shown, and not less than six days' notice shall be given of variations of such schedules to meet special occasions.

(*c*) That the question of spread-over time be left to each undertaking to confer with the representatives of the Trade Union with a view to reducing the same to the lowest possible minimum.

CLAUSE 2.—GUARANTEE.

(*a*) All employees entitled at this date to a guaranteed 48 hour week shall retain such guarantee, provided—

(1) That the employee has presented himself for work at the appointed time on each day.

(2) That the employers shall be at liberty to allot to any employee for whom work cannot be found at his regular occupation, such other work as may be considered suitable by the management, subject to such work being only of a temporary character.

(3) That in the event of a stoppage in the tramway service, whether complete or partial, from causes beyond the control of the tramway authorities, such as stoppage due to disputes, serious breakdown of machinery, or short time in local industry, the guaranteed week shall be suspended, and only the actual time worked shall be paid for.

(4) In the event of any dispute of Clause 2*a*, sub-section (3), such dispute shall be referred to the National Council for settlement.

(5) In the event of a partial stoppage, the tramway authority shall consult the local representatives with a view to enabling the work to be divided equitably amongst the employees.

(*b*) (1) The total number of new entrants into the service who are not to receive a guaranteed week of 48 hours shall in no case exceed a maximum of 10 per cent. of the total number employed; and these shall be guaranteed a week of not less than 32 hours, to be completed within six days.

Note.—The precentage of the men required within the limits of the 10 per cent. shall be, in the first instance, the subject of local negotiation, it being understood that failing agreement, the determination shall rest with the management.

(2) In the event of a man being called out he shall be paid a minimum of four hours for the first call, and two hours for each succeeding call in the day.

CLAUSE 3.—OVERTIME.

(*a*) An employee working in excess of his scheduled duty on the rota of duties of a service or route, shall be paid at the rate of time and a quarter for the first two hours, and time and a half after.

(*b*) In the event of an employee working voluntarily at the request of the management on his "Rest Day" he shall be paid a rate of 25 per cent. in excess of the rate prevailing on that day, but such time worked shall not count for weekly overtime.

CLAUSE 4.—HOLIDAYS.

(*a*) Employees shall be entitled to eight days' holiday annually with pay, after 12 months' continuous service. Holidays shall be taken by the employees at such time of the year as may be agreed locally.

(*b*) In respect of the four National Holidays, viz., Easter Monday, Whit Monday, August Bank Holiday, and Boxing Day, and any National Festival, time and a quarter rates shall be paid, except in districts where such holidays are not recognised, when ordinary rates shall be paid, and four other holidays shall be substituted.

(*c*) Christmas Day shall be worked, when required, and double ordinary week-day rates shall be paid for the time actually worked, with a minimum of four hours' work. Local consideration shall be given to the working hours of the Schedule on that day.

(*d*) In respect of Sundays, time and a quarter rates shall be paid.

(*e*) Employees who voluntarily leave the service, or who are dismissed for misconduct, shall not be entitled to any allowance in lieu of holidays.

(*f*) In calculating holidays for the purpose of payment, "Rest Days" shall not be included.

(*g*) No employee shall be entitled to payment in lieu of holidays.

CLAUSE 5.

Added rates of pay shall not be taken into calculation for the purpose of making up the guarantee.

CLAUSE 6.

Clauses 1 (*b*), 3 (*a*) and (*b*), 4 (*b*), (*c*) and (*d*) may be modified by agreement between the management and the Trade Union representatives in the case of small undertakings, or undertakings where the traffic, owing to seasonal or other causes, is of a special character.

CLAUSE 7.

(*a*) The working week of the Depot Day Staff employees shall be 47 hours.

(*b*) The working week of the Depot Night Staff employees shall be 48 hours, such hours to include a meal-time allowance of not less than 30 minutes each night.

CLAUSE 8.

Permanent Way employees, and employees whose wages, overtime rates, and conditions of service may be regulated by those of other industries, shall be excluded from the provisions of this Agreement. Pending negotiations for a new Agreement in respect of permanent way employees whose conditions of service are governed by the Agreement of March, 1919, that Agreement shall continue in force until May 1, 1922.

CLAUSE 9.

Any privileges or emoluments or conditions of service enjoyed under Clause 10 of the Agreement of March, 1919, may be discontinued six months after this Agreement comes into force, provided that the employees have not come to a local agreement, nor satisfied a committee of the National Council that they are entitled to the continuance of such privileges or emoluments or conditions of service, and failing agreement by such committee, an independent person shall be appointed with power to modify or decide. An employer shall give reasonable notice to the employees of the privileges, emoluments, or conditions of service which they desire to discontinue.

CLAUSE 10.

The terms of this Agreement shall operate as and from the commencement of the first full pay period after April 17, 1922, and shall be terminable upon three months' notice from either side.

CLAUSE 11.

Any dispute arising as to any portion of this Agreement, shall be referred to the National Joint Industrial Council for settlement.

(Signed) J. BECKETT, J. CLIFF, A. DE TURCKHEIM } *Joint Secretaries.*

Ministry of Labour,
March, 1922.

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LONDON UNDERGROUND GROUP.

ANNUAL MEETINGS OF RAILWAY AND OMNIBUS COMPANIES.

The annual meetings of the companies included in the London Underground "Common Fund Group" were held in the Caxton Hall, Westminster, on February 23, Lord Ashfield, the chairman of the directors, presiding. The companies concerned (a summary of whose reports is given in another column) were as follows—The Metropolitan District Railway, London Electric Railway, Central London Railway, City and South London Railway, and the London General Omnibus Company.

Metropolitan District Railway.

Addressing the shareholders of this company, Lord Ashfield referred to the efforts which had been made to secure the co-ordination of all the traffic facilities in London. After mentioning that the conference between the Underground Group and the London County Council on this matter had had to be abandoned, he said that the question was reopened once again by the appointment of the present Royal Commission on London Government, presided over by Lord Ullswater. "Your company, in concert with its associates," Lord Ashfield proceeded, "is giving careful consideration to the evidence to be submitted to the Commission at a later date, and here, perhaps, I may again affirm the principles upon which our action has been governed in the past. We do not object to an adequate and safeguarded measure of public control by an independent body. We believe that will tend to good results, but to ensure them we think that with control should also go a measure of protection. In fact without protection against unfair and quite unnecessary disturbance there is no means of securing control. The one is a natural consequence of the other. While agreeing with public control, we believe that only by private enterprise can the operation of London's transport facilities be carried out successfully." They could only hope that the report and recommendations of the Royal Commission would render any necessary legislation possible in an atmosphere which would be conducive to a fair and equitable settlement.

Dealing with the traffic results of the past year, Lord Ashfield alluded to the disastrous effects of the coal strike and the subsequent trade depression, but for which, he said, the expectations of the group of companies would have been reached. "Certainly we were right in so far as the revised level of fares was concerned. Taking the four railway companies together, the passengers carried in 1921 amounted to 339,000,000 in round figures, or 65,000,000 less than in 1920, equivalent to a decline of 16 per cent. No fewer than 21,000,000 of these lost passengers were workmen, representing in their case a decline of 28 per cent., and indicating only too clearly the stagnation of trade and industry. Taking the passengers carried by both railways and omnibuses in the common fund group the total number for the year 1921 is 1,100,000,000, or 72,000,000 fewer than in the previous year, from which you will observe that the falling off in omnibus passengers is under 7,000,000, or less than 1 per cent."

Lord Ashfield dealt at length with the scheme put before the Government last autumn for various extensions of the present railway system, approval of which was declined. He said that a revised scheme had been submitted to the Special Committee appointed by the Government, which, he hoped, would be acceptable. With the provision last year of additional rolling stock, the car sheds and shops were inadequate, and advantage was taken of the opportunity to provide accommodation for overhaul and maintenance of the rolling stock of all the associated railway companies in a single centralised establishment with its resultant economies. A site had therefore been acquired adjacent to the Acton Town Station, upon which a commencement had been made in the erection of a new central works. The total amount which it was expected would be spent in the next two years upon these works was £176,000, making a total expenditure of about £350,000.

London Electric Railway.

In the course of his speech at the meeting of this company, Lord Ashfield referred to the new experimental train with air-worked doors on the Piccadilly section. Alterations to rolling stock were in progress to provide ten trains of this type. The convenience of passengers and the speed of operation were increased by the additional and wider doors, and there was a reduction in the number of men required per train. He also alluded to the new type of booking office constructed and worked with considerable success at Kilburn Park Station (described in our issue of January 19, 1922), and said the experiment was being extended to several other stations. The ratio of working expenses to receipts on the railways during 1921 was 70 per cent. This was much too high for remunerative operation, but there was a lively hope of its being reduced to a more normal proportion, even though they could not expect to reach the 50 per cent. of the year immediately before the war.

Central London Railway.

Lord Ashfield pointed out that the year 1921 was the first during which the extension railway from Shepherd's Bush to Ealing had been continually worked. Under the agreement with the Great Western Railway Company that company maintained the railway and stations and the Central London Company worked the train service, receiving a share of the traffic receipts attributable to the extension railway. He regretted that this share of the traffic receipts had barely been sufficient to meet the expenses incurred during last year. This was due to the higher fares charged upon this route, necessitated by the fact that the railway from Shepherd's Bush to Ealing Broadway was a part of the Great Western Railway. Progress was being continued with the transfer of the power supply from the generating station at Wood Lane to the Lots Road power-house, and further expenditure amounting to £11,900 was shown in the accounts contemplated in this connection. The last steam locomotive belonging to the company had now been removed from the active list. There had been a decline in passengers, the number carried falling approximately from 50 millions to 43½ millions, or by 13 per cent.

City and South London Railway.

Reference was made by Lord Ashfield to the need for more modern equipment and enlarged tunnels on this railway. He added that the management had joined with the London Electric Railway Company in putting forward an application to the Government for a grant of sufficient money to enable this reconstruction to be carried out. Traffic had declined by more than 9,300,000 passengers during the year, representing a drop of 23 per cent. The decline was the most severe upon this railway than upon any of the railways in the group. They hoped therefore that they would receive a favourable answer from the Government, and that they would be enabled to proceed with the work during the present year.

London General Omnibus Company.

Lord Ashfield said considerable progress had been made in the replacement of the pre-war type of omnibus by larger omnibuses of modern and improved design. By the close of the year 926 "K" type omnibuses, each seating 46 passengers, and 205 "S" type omnibuses, each seating 54 passengers, were brought into service by the L.G.O.C. alone, and similar steps to reinstatement had been taken by the allied motor omnibus companies. The experience obtained of the working of the "S" type omnibus had been good, and the company felt justified in proceeding with orders for further substantial numbers, which it was expected would be added to the fleet during the first half of the current year. After alluding to the opening of the new Central Overhaul Works at Chiswick, (which were fully described in our issue of February 16, 1922), the chairman said that with the purchase of the additional omnibuses it would be necessary to provide further garage accommodation. It was therefore proposed to enlarge the garage at Forest Gate and to build a garage at Barking. It was further intended to build a small garage to the north of Walthamstow in relief of Leyton, and others at Dunton Green, near Sevenoaks, Hatfield, and in the Guildford area. The miles of roads occupied had increased from 568 at the commencement of the year to 685 at the close of the year, or by 117 miles. The L.G.O.C., who hitherto worked and maintained under agreement the motor omnibuses of the Gearless Motor Omnibus Company and the Tramways (M.E.T.) Omnibus Company, had now taken steps to acquire, as from January 1, 1922, the shares and undertakings of these companies, so that there might be a further consolidation of interests. To summarise the principal feature of the year 1921, it had been a resumption of progress interrupted by the war, and the development of omnibus services to provide satisfactorily and fully for the whole of the Greater London area.

The number of passengers carried was 761,250,000, or 6,700,000 less than in the previous year. There seemed to be a general lack of money, which restricted the number of rides taken by the population, and until there was a restoration of prosperity among the inhabitants, he was afraid they could not look forward to an expanding traffic. The revised fares brought into effect on September 26, 1920, continued in force until December 1, 1921. These met, as was expected, the financial requirements of the companies, and served to put transport on a reasonably remunerative basis. Lord Ashfield alluded to the reduction of fares made by the London County Council on December 1, 1921, which was followed by a corresponding reduction on the part of the omnibus companies. Proceeding, he said that the mileage worked by omnibuses had increased from about 86 millions to 87 millions of miles, or by just over 1 per cent. On the question of accidents, he pointed out that the record of the companies during last year had been better than it had ever been in the history of the companies.

Referring to their attempts to co-operate with the London County Council in providing motor omnibus services, Lord Ashfield said that the loss on the working to meet the requirements of the London

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County Council had amounted to £22,000 in the course of the year. Through tickets between the Council's tramways and the omnibuses were issued at various points, but the number of these tickets sold in the year was only 260,000. They represented a very small proportion of the exchanging traffic, and it hardly seemed to merit the special facilities which had been offered.

UNDERGROUND ANNUAL GROUP REPORTS FOR 1921.

METROPOLITAN DISTRICT RAILWAY.—In consequence of the Government control of the company's railway during 1920, certain figures for that year are not comparable with those for 1921, and are omitted. The net receipts for 1921 show an improvement of £164,041, but as miscellaneous net receipts are smaller by £41,328, the gain in total net income is limited to £122,713. After deducting fixed charges, which show the small decrease of £611, and placing £65,000 to reserve, against £45,000 only last year, the available balance, including the amount brought in from 1920, is £291,330, an increase of £101,763. The full dividend of 5 per cent. is paid on the second preference stock, against only 3 per cent. for 1920, and the ordinary stock receives 1 per cent., the first distribution on that stock since 3-16 per cent. was paid for 1882.

LONDON ELECTRIC RAILWAY.—There is an increase in receipts of £223,091 at £2,040,010, but expenses are down £18,523 at £1,368,771. Net receipts are therefore up £241,614 at £671,239. Miscellaneous net receipts were £136,804, and the balance from last account £22,350. After deducting £295,544 for interest and rentals and £65,000 for reserve and meeting preference dividend, there is enough to pay 3¼ per cent. on the ordinary, and carry forward £39,744. Capital expenditure came to £135,905.

CENTRAL LONDON RAILWAY.—Total receipts aggregate £661,479, an increase of £83,096, but expenditure was reduced by £16,704 to £468,428. Net receipts are up £99,800 at £193,051, and miscellaneous receipts come to £68,071. The balance from last year was £15,161. Interest and rentals absorb £46,039, and £29,000 is placed to reserve, an increase of £9,000. The preference dividend absorbs £21,600, and 4 per cent. is paid on the ordinary and preferred ordinary stocks, leaving £59,644 to be carried forward. The capital expenditure came to £8,185.

CITY AND SOUTH LONDON RAILWAY.—With an increase in receipts of £19,008, and a decline in expenses of £20,470, the net receipts show a gain of £39,478 to £145,558. Miscellaneous net receipts are also up £2,000, and as fixed charges are down £2,208, the available amount, including the slightly smaller balance brought in, shows an increase of £43,356 at £151,876. The sum of £36,000, or £11,000 more than last year, is placed to reserve. The consolidated ordinary dividend is raised from 1½ per cent. to 3¼ per cent., and the "carry forward" from £18,820 to £25,276.

LONDON GENERAL OMNIBUS.—An expansion of £566,241 is shown in receipts to £7,500,572, but an increase of expenditure of £260,844 at £6,936,082. Miscellaneous receipts came to £183,552. Interest and rentals reached £152,474, and £335,000 was appropriated to reserve, an increase of £50,000. The dividend is 8 per cent., free of tax, against 5 per cent., free of tax, and £67,928 is carried forward, against £58,843 a year ago. The expenditure on capital account was £664,402. The company now works 685 road miles.

ELECTICITY (SUPPLY) BILL.

The second reading of this Bill was passed in the House of Lords on March 8. The Earl of Bessborough urged that there should be some time limit to the amount which local authorities should be permitted to borrow for the purpose of the joint electricity undertakings. Viscount Haldane contended that there was a tremendous case for the Bill, particularly in relation to the conservation of the national coal supplies. Small generating stations were always wasteful. In London there were 70 generating stations, 50 different systems of supply, 24 different voltages, and 10 different frequencies. How could they be efficient in that way? There were 600 generating stations in the country, and their output was ridiculous when compared with modern standards. Opposition to the Bill was, he said, epitomised in a newspaper headline, "Flank attack on private enterprise." Lord Buckmaster objected to placing the exercise of expert powers in inexpert hands. With the best will in the world, local authorities could make the most profound mistakes. The Marquis of Salisbury said the moment was inopportune for placing a still further burden on local rates. Lord Gainford urged that private enterprise should be given a freer hand rather than that the community should be subjected to increased rates and taxation. On a division the motion for a second reading was carried by 59 to 40.

LONDON "SAFETY FIRST" COUNCIL.

ANNUAL MEETING AND PRIZE DISTRIBUTION.

The annual meeting of the London "Safety First" Council was held at the Mansion House on February 22, under the presidency of the Lord Mayor. A large attendance included many omnibus, tramcar, and other vehicle drivers, to whom the slogans of the movement are so familiar and useful. The annual report contained a review of the Council's activities during the five years of its existence. After an allusion to the success of last year's "Safety First" essay competitions for school children and children of railway employees, the report stated that the "Freedom from Accidents" competition for drivers had grown in popularity and the number of entrants had advanced to nearly 7,000. The possession of the Council's badge is keenly sought and, when obtained, is greatly valued. There could be no doubt that the successful operation of these two competitions contributed materially to the diminution of fatal street accidents which, during the nine months ended September 30 last, declined by about 17 per cent.

LEFT-HAND RULE OF THE FOOTPATH.

After nearly five years persistent advocacy of a left-hand rule of the footpath, substantial advance had been made in that, following endorsement by the principal municipal associations and by the Advisory Committee on London Traffic, the Minister of Transport stated he would have no objection to the Council recommending municipalities to exhibit notices "Keep to the left of the footpath." A communication had been addressed by the Ministry to the Municipal Corporations' Association, the County Councils' Association, the Urban District Councils' Association and the Rural District Councils' Association, drawing attention to a resolution of the Roads Advisory Committee to the effect that it considers "it desirable that footpath traffic and vehicular traffic should conform to the same rule, and that steps should be taken to enlist the co-operation of local authorities in the matter, also asking that the subject might be placed on the agenda for the consideration of each association, so that the views of their members may be ascertained upon the expediency of concerted action being undertaken by all local authorities in the introduction of the new practice." In the Greater London area, the London County Council, 24 borough councils and 31 urban district councils had pronounced in favour of the suggested regulation. In the interests of public safety the Council reaffirmed to the Ministry of Transport its opinion that the regulation respecting rear lights should be reimposed.

Particular consideration had been given to the important subject of the rectification of dangerous corners, street refuges, and certain other features which might constitute a danger to traffic. A majority of the railway companies operating in the London area actively supported the Council and had granted valuable space for the display of bulletins. Of a total of 18 Meritorious Service Awards granted by the Council, five had gone to railway servants for conspicuous gallantry in preventing accidents.

The report concluded with an appeal for greater support. The Council fully recognise that there is an ever-widening scope for its activities, and that there is need for greater educational publicity, increased propaganda, and more intensive effort. These, however, involve the expenditure of money, it is pointed out, and lack of funds stifles progress and expansion.

TRIBUTES TO COUNCIL'S WORK.

The Lord Mayor congratulated the Council on the useful work it had done in the five years it had been in existence, and said the record was all the more remarkable when one considered the small expenditure with which it had been effected.

Sir Henry Maybury (Director-General of Roads, Ministry of Transport), moving the adoption of the report, referred to the decrease in the number of street accidents since 1914, notwithstanding the large increase in the number of vehicles. This was largely due to the operations of the "Safety First" movement. About 90 per cent. of all street accidents could be avoided. The public needed educating, and the "Safety First" Council was doing a great work. Mr. H. E. Blain seconded, and read a letter from the Duke of York regretting his inability to attend, and expressing the hope that the society would continue to flourish.

The Duke of York was unanimously re-elected president of the Council, and the following were elected vice-presidents—Lord Leverhulme, Sir Alfred Mond (Minister of Health), the Lord Mayor, Sir William Joynson-Hicks, M.P., and Sir Henry Maybury.

The Lord Mayor then presented the 90 awards in the "Freedom from Accidents" competition, and the awards for stopping runaway horses.

In November, the offices of the Council were transferred to 15, Savoy Street, Victoria Embankment, W.C.2, where better accommodation for meetings has been secured.

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L.C.C. AND LONDON UNITED TRAMWAYS.

THROUGH RUNNING AGREEMENT.

At the meeting of the London County Council on February 28 the Highways Committee reported that the Council on January 31, 1922, decided to serve on the London United Tramways notice of its intention to complete the purchase of the company's undertaking in London on May 2, 1922. Under the agreement with the company dated December 6, 1917, if the company are not required to work exclusively the lines purchased, the Council is at liberty to run over the company's lines in Middlesex jointly with the company, and the company are at liberty to run jointly with the Council over the lines purchased, the mileage being equal and each party accounting for gross receipts taken, the other terms and conditions being agreed or determined by arbitration; further, each party is to have the right to fix and alter fares on its own tramways. The Highways Committee have been in communication with the company as to the through running arrangements after the transfer of the lines, and as a result it is proposed that instead of the provisions of the agreement as to running being carried into effect at the time of transfer, those provisions shall remain in abeyance while the arrangement referred to below is in force. The Highways Committee therefore recommended that an agreement be entered into with the London United Tramways to provide that, for a period of three years and thereafter until determined by either party by six months' previous notice—

(i.) The company shall continue to operate the lines transferred to the Council in Hammersmith; (ii.) the Council shall run one service from Hammersmith to the county boundary and thence along the company's lines to Kew Bridge or such other point on the company's system as may be agreed; (iii.) the Council shall operate the whole of the service on the company's lines between the county boundary at Merton and Wimbledon; (iv.) each party shall retain the receipts from its own cars; (v.) the company shall fix the fares on the transferred Hammersmith lines subject to their not increasing the fares beyond the rates at present in force; and (vi.) the Council shall fix the fares on the route from the county boundary at Merton to Wimbledon, and that the Highways Committee settle the other terms and conditions of the agreement.

In connection with the taking over by the Council of the portion of the London United Tramways in London it will be necessary, in order to provide the proposed through services to Wimbledon via Merton, for a change-over point to be installed in the tracks at the present Merton terminus, for the overhead poles and wires to be extended, and for a physical connection of the tracks to be made. The works will be carried out under the provisions of Section 12 of the London County Council (Tramways and Improvements) Act 1901, and the Wandsworth Metropolitan Borough Council has been asked to consent to the proposal, as required by the Act. The cost of the work is estimated at £1,550. The company will meet half the interest and sinking fund charges.

THE MINISTRY OF TRANSPORT.

Time to be taken to Consider its Future.

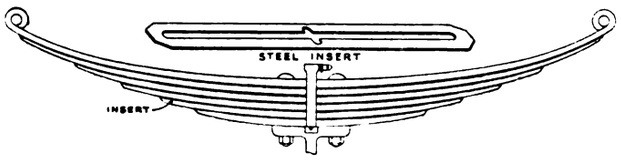
In the House of Commons on March 1, the Chancellor of the Exchequer made a statement of the Government's action with regard to the report of the Geddes Committee. The revised estimate for the Ministry of Transport for the year beginning in April next was, he said, £243,000, but since then the department had brought the estimate down to £211,000. The Geddes Committee recommended that the Ministry should be transferred to the Board of Trade. That might be ultimately the right thing to do, but there were many things which the Ministry still had to wind up, and which by statute could only be done by the Ministry. There was a Minister of Transport, but he was doing his work gratuitously, and there would be no saving in a transfer to the Board of Trade at present, except what was involved in the salary of the Under Secretary. If it were quite certain that the Board of Trade was the best home for whatever Ministry conducted the operations of transport, they might resolve now that the transfer should take place. There were, however, things which could not suitably be dealt with by the Board of Trade at all—roads, for example. These would be better dealt with in the Ministry of Health, which treated with local authorities. The Government thought it would be better to take some time to consider the whole matter in connection with what they must consider soon—a large reorganisation of Government departments. There would be much to be said for uniting the Ministry of Transport with the Post Office, and having a Ministry of Communications. That had been strongly urged, and he only suggested it to show that there might be many points of view, and that it was better to get the right one than to act precipitately now.

LAMINATED SPRING LUBRICATOR.

A CENTRE-FED SYSTEM.

With the laminated type of spring in general use on most types of road and rail vehicles it is somewhat strange to find that more attention has not been paid to the question of efficient lubrication between the component metal leaves. A device which the manufacturers claim will ensure thorough and constant lubrication throughout a laminated spring is being introduced into the United Kingdom by the Anger Manufacturing and Supply Company, Limited, of Bank Chambers, Preston. "Centre-fed spring inserts" consist of strips of low carbon steel, ·025 in. thick, with a ¼-inch slot running down the centre. These are interposed between each lamina of the spring, so that the central slot extends to within one inch of either end. Oil is fed to each "insert" from a centre channel by means of a high-pressure gun.

By this method, the manufacturers point out, a distinct advantage is gained in that oil passes from within the spring outward, and not—as is commonly the case—from the outside of the leaves inward, carrying grit or other impurities with it. The lubricant reaches every part of the spring, and when a fresh supply is needed the old oil is cleaned out with paraffin forced through the leaves. By the use of the pressure oil-gun any grade of heavy engine oil may be driven into the spring within a period of from eight to ten minutes, after about every 500 miles running. The Anger Manufacturing Company assert that this treatment prolongs considerably the life of the springs, prevents breakage, precludes rust, and eliminates the tendency of the springs to creak. These qualities are reflected in an improvement of the tyre and petrol mileage; they lessen the depreciation of the car, and will cause any standard set



Centre-fed Spring Insert.

of springs to last as long as the car itself. Efficient spring lubrication in passenger vehicles may also, of course, be expected to enhance the comfort of riding.

We understand that the centre-fed spring inserts are being adopted by some of the largest motor vehicle manufacturers in the United States, and that the device is giving much satisfaction. On a recent test a car so equipped travelled 38,000 miles, after which the springs were examined. No wear of the inserts was apparent to the naked eye, nor could any wear be found on the leaves of the springs. Tests obtained from runs of from 5,000 to 40,000 miles have given equally gratifying results.

The Anger Manufacturing and Supply Company, Limited, are the sole concessionaires for the British Isles, and all foreign countries, and the spring inserts are patented throughout the world. Their manufacture is now to be carried on in the British Isles.

DYNAMOS AND THEIR ATTENDANTS.

The publication of the tenth edition of "Dynamo and Motor Attendants and their Machines," from the house of S. Rentell and Company Limited, 36, Maiden Lane, W.C., is in itself almost sufficient tribute to the popularity and usefulness of this book by Mr. Frank Broadbent, M.I.E.E. As a work of reference and a guide to motor mechanics and others concerned with electrical plant, the previous editions have won much popularity. The text has now been revised and enlarged to meet enquiries from readers, with the result that the impression now in our hands is thoroughly up to date and comprehensive. From the preface we learn that the main revisions concern "the permissible temperature limits of dynamos and motors, and the method of reversing induction motors. The sections on these subjects have been re-written, and two simple diagrams have been added to strengthen the written explanation of the principle of reversibility." Another section which has been amplified is the appendix describing the method of testing the polarity of the magnets of dynamos and motors. The book, neatly bound in cloth, is published at 4s. 6d. net.

A New Trolley Omnibus.—The Associated Equipment Company, of Walthamstow, has constructed a trolley omnibus which has been tried with very satisfactory results on several tramway routes in the London district, current being taken from the tramway overhead wires.

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FINANCIAL REPORTS AND MEETINGS.

PAISLEY DISTRICT TRAMWAYS COMPANY.—The profits for 1921 were £34,736. A dividend of 4 per cent. is proposed on the ordinary shares, carrying forward £8,932.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, LIMITED, have announced a final dividend on the ordinary shares of 2s. per share, less tax, making 3s. per share for the year, less tax.

NORTH METROPOLITAN ELECTRIC POWER SUPPLY COMPANY.—The issue of £250,000 8 per cent. cumulative second preference stock was subscribed for over 13 times by more than 3,000 applicants.

JERSEY RAILWAYS AND TRAMWAYS.—The gross receipts for 1921 were £22,506, and net receipts totalled £2,927, less interest on debentures, £1,035, leaving £1,892, plus £618 brought forward, making £2,511. The directors recommend a dividend of 5 per cent. on ordinary shares, carrying £811 forward.

WALLASEY'S HAPPY POSITION.—Wallasey Corporation Tramways (the general manager of which is Mr. R. R. Greene) are able to relieve the rates to the extent of £8,500, in spite of the fact that since April 1921, there has been a decrease of 3,023,137 in the number of passengers. A surplus of £18,000 had been anticipated, but owing to the heavy slump in traffic this was not realised. An increase in the price of fares, however, helped to right matters, and Wallasey was one of the five undertakings which last year paid their way. The omnibuses made a profit of £860, though a loss of £545 had been estimated. Penny fares were recently restored on the tramways.

YORKSHIRE (WEST RIDING) ELECTRIC TRAMWAYS COMPANY, LIMITED.—The report for the year ended December 31, 1921, shows that after providing for debenture interest there was a net profit of £33,071 13s. 9d. This has been appropriated as follows—Dividend at 6 per cent. per annum, less income-tax, on the 6 per cent. cumulative preference shares, £9,714; renewals, depreciation, and reserve fund in lieu of accident insurance, £19,126; carried forward, £4,230. The directors record with regret the death of their colleague, Mr. Benjamin Newgass. Mr. H. England, who has been general manager of the company since its inception, has been appointed a director to fill the vacancy.

SUNDERLAND DISTRICT TRAMWAYS, LIMITED.—At the annual meeting held in London, the chairman (Mr. H. R. Hogg) said the gross receipts for the year were £72,029, against £74,055 in the previous year. Running expenses were £55,511, against £53,784. This included £17,114 repairs and renewals. After deducting depreciation and the other usual items, the sum of £11,051 remained, against £16,187 last year. Adding the balance brought forward, and deducting the interest on the prior lien bonds and debentures, and the sinking fund instalment on the former, there remained £4,993. The board recommended a payment of the 5 per cent. interest on the income bonds, amounting to £4,065, and the carrying forward of the balance of £927, compared with £1,542 last year. This was agreed to.

LANARKSHIRE TRAMWAYS COMPANY.—The accounts for the year ended December 31 last show that the revenue amounted to £227,450 and the expenses £188,510, leaving a gross profit of £38,940, less contributions to local authorities, £2,009; interest on debentures, £640; interest account, £2,698; interest account—Lanark County Council Tramways, £621; and transferred to reserve for depreciation, £10,000; leaving a balance of £22,971, which with £1,131 brought in, totals £24,102. The directors recommend a dividend of 6½ per cent. per annum for the half-year ended December 31 last, making 5¾ per cent. for the year, placing £2,183 to revenue new account. The revenue shows a reduction of £2,096, due to the coal stoppage and severe trade depression last year. The expenses were reduced by £9,467 in spite of additional expenditure involved by the coal stoppage.

TYNESIDE TRAMWAYS AND TRAMROADS COMPANY.—The half-yearly meeting was held in Newcastle on February 14, Dr. J. T. Merz presiding. The chairman regretted that the dividends would be the smallest paid since 1912. As to the prospects of the company, it could be said that for the first six weeks of the present year business was about level with that of last year. On the whole, there was a slight indication of improvement. Dividends were sanctioned at the rate of 5 per cent. per annum on preference shares, and 2 per cent. per annum on ordinary shares (making, with the September dividend, 2½ per cent. for the whole year). The accounts for the half-year ended December last show a surplus of receipts over expenditure of £4,971, and £140 is brought forward. The reserve and depreciation fund is increased by £500, and £591 is carried forward.

LANCASHIRE UNITED TRAMWAYS, LIMITED.—The profit for 1921, less working expenses, general charges, and rent of leased lines, was £28,217. Receipts show a decrease of £14,881, and expenditure an increase of £7,754. Interest and dividends from operating company, plus motor coach and sundry receipts, was £69,761. Deducting motor coach and other expenses and interest on prior lien debenture stock, there remains a balance out of which interest at 2½ per cent., less tax, will be paid on second mortgage debenture stock for the year, leaving £1,126 for depreciation. The balance on working of operating company, after payment of interest and dividend, was £10,248. Depreciation and renewal account (after writing off £5,000 for depreciation on motor coaches and omnibuses) and amounts carried forward in combined companies now amount to £183,642.

LLANDUDNO AND COLWYN BAY ELECTRIC RAILWAY.—The report for the year ended November 30, 1921, shows that the profit amounted to £6,194, and, including £2,548 brought from the previous year, there is a total available balance of £8,742. For the redemption of debenture stock £2,040 is allocated, and the directors recommend the transfer to the reserve for repairs and renewals of £2,500 and the payment of a dividend of 4 per cent., less tax, requires £2,783, leaving £1,419 to be carried forward. The traffic receipts amounted to £38,035. During the early summer months the receipts were adversely affected by the restriction in the supply of electric current owing to the coal strike. Four new open type cars proved popular during the summer months. Increased fares were in operation for the whole of the year, and the receipts on the whole were satisfactory. The directors state that there are indications that the highest level of expenses is now passed.

FIFE TRAMWAY, LIGHT AND POWER COMPANY, LIMITED.—The annual meeting was held in Edinburgh, on February 24, Mr. William Low (the chairman) presiding. As in the case of the Power Company, he said, the receipts of the tramway undertakings had been affected by the coal strike and trade depression. Since the close of the accounts an issue of £250,000 7 per cent. debenture stock was made, which would enable the company to repay outstanding loans, and for the first time for some years have cash available for development purposes. The gross revenue from the company's properties amounted to £78,394, compared with £72,801 for the year 1920. The balance available after deducting debenture and loan interest, fees, etc., transfer of £17,000 to reserve, and allowing for the amount brought forward, was £41,037, out of which the full dividend on the preference shares for the year had been paid, leaving an undistributed balance of £30,117. After payment of a dividend on the ordinary shares at the rate of 8 per cent., £4,357 would be carried forward.

BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY, LIMITED.—The annual report for the year ended June 30, 1921, which was presented at the general meeting held in London on February 14, shows that the net revenue, after providing for depreciation, sinking fund, renewals, etc., was £421,277, and that with the balance brought forward this amounted to £433,923. It was decided to pay the following dividends—Final dividend on the preferred ordinary shares at the rate of £1 3s. 8d. per cent. per annum, free of income-tax, making, with the dividend of £3 10s. per cent. paid in August last, £4 13s. 8d. per cent. free of income-tax a final dividend on the deferred ordinary shares at the rate of £2 14s. 2d. per cent. per annum free of income-tax, making with the dividend of £3 10s. per cent. paid in August last, £6 4s. 2d. per cent. free of tax. The amount carried forward was £24,000. Owing to the high cost of living, the company had to concede demands for increased wages in October, 1920, but since that time there has been a substantial fall in the cost of living, and an adjustment of wages in a downward direction is being made. On the other hand, the report states, taxation continues to increase.

PAISLEY DISTRICT TRAMWAYS COMPANY.—The annual meeting was held on February 22, Mr. Owen H. Smith presiding. The chairman said the traffic had increased in spite of the trade depression, but the expenditure had also increased. The general result was a profit of £34,736. After providing for general interest, income-tax, interest and sinking fund on debentures, the usual appropriation to general reserve, and providing the 5 per cent. dividend and sinking fund on the preference shares, they were able to recommend a dividend of 4 per cent. on the ordinary shares, and increase the amount carried forward from £6,545 to £8,032. The amount added to general reserve for the year was £12,139, to the sinking funds £5,754, and to the carry forward £1,487—in all £19,380—a very satisfactory total. The chairman referred to the suggested purchase of the undertaking by Glasgow Corporation, and replied to various criticisms which had been made of the company's system in the discussions on the matter. "Should they decide to offer us a price that we consider fair and reasonable," he remarked, "we shall hope to complete an agreement for sale. Should the negotiations not come to anything, no harm will have been done."

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TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

ROUTE EXTENSIONS—LOYAL EMPLOYEES.

At a meeting of the Tramways Committee on February 15, Councillor W. G. Turner presiding, it was decided to recommend the Council to promote a Bill in Parliament for the acquisition of additional lands and buildings contiguous to Bellevue Gardens (a pleasure resort maintained by the Tramways Committee). A scheme of tramway extensions was also discussed, and it was agreed that a special meeting should be held at an early date, and that the reports which were before the committee about 18 months ago on this subject should be re-submitted, with revised estimates. Councillor Turner has informed the City Council that he has received many expressions of appreciation of the loyalty of the motormen and conductors during the last 18 months under very trying circumstances. During the whole of that period not one member of the traffic staff refused to pass through the dangerous areas. The committee, recognising the strain placed on these men, decided, in response to an application from their trade union, to grant them four days' extra holiday this year.

BIRMINGHAM.

LATER CAR SERVICE.

The Tramways Committee decided to extend the hours during which the tramcar and omnibus services are run, so that the last cars will leave the city termini at 11.30 p.m., instead of 11 o'clock. The committee also decided to give a trial on the Harborne route to an omnibus of one of the latest London types.

BOLTON.

PRE-WAR FARES.

The Corporation Tramways Committee have decided that from Monday to Friday between the hours of 12 noon and 2 p.m. the ordinary pre-war fares shall be re-established. This has been confirmed by the Town Council. The same privilege had formerly been granted up to 9 a.m. and between the hours of 5 and 6.30 p.m., so that the pre-war fares from April 3 next will be as follows—Monday to Friday, up to 9 a.m., 12 noon to 2 p.m., and 5 p.m. to 6.30 p.m.; Saturday up to 9 a.m., and from 12 noon to 1.30 p.m. At all other times and on Saturday afternoons and Sundays, ½d. extra will be added to the fares on each route. The fares for children however, have never been increased and are still at pre-war level. Bolton was one of the last undertakings in the country to make any alteration in fares, the first revision being made in April, 1921.

BRADFORD.

TRACK CONSTRUCTION—TRAMCARS OR TROLLEY VEHICLES ?

The Corporation Finance Advisory Sub-committee have approved the proposal that applications should be made for sanction to borrow £17,242 and £19,000 respectively for tramway track in Thornton Road, Listerhills, and the new road at School Green. At a recent Government inquiry into the Corporation's application for borrowing powers, the tramways manager (Mr. R. H. Wilkinson,) said that owing to the increased cost of tramway track construction, 75 per cent. of the lines would eventually have to be abandoned unless some form of transport cheaper than the tramway car was adopted. The city engineer stated that no ill effects had been noticed on the roads over which the Corporation were running railless trolley vehicles.

CARDIFF.

ROUTE EXTENSIONS.

The Tramways Committee have appointed a sub-committee to consider the question of tramway extensions in various parts of the city. It is not, however, intended to proceed with any extensions at present.

DOVER.

TRAMWAYS AND RAILLESS TRACTION.

The Tramways Committee have received reports from a deputation which they sent to inspect the railless trolley systems of York, Leeds and Bradford, with a view to a similar method of traction being adopted in certain parts of Dover. The general manager of the tramways (Mr. E. H. Bond) reported that the weight of evidence obtained was in favour of railless as "a sound, practical proposition." He estimated that the total cost of installing such a system in Dover, with three cars, would be £9,850, or with four cars, £12,300. The committee decided to defer consideration of the matter for two months, and in the meantime to carry out necessary repairs to the tramway track.

DUBLIN.

UNITED TRAMWAYS MEETING.

Speaking at the annual meeting of Dublin United Tramways Company, the chairman, the Rt. Hon. L. Waldron, said that by agreement with their employees the company had recently decided to reduce their wages by 4s. per week in two instalments of 2s. on February 1 and March 1 respectively. He added that the management thought the reduction should have been 5s., but in order to produce peace and goodwill they yielded to the lesser reduction. The chairman paid a tribute to the "great patience and courtesy" of the drivers and conductors, to the willing and able support accorded by the higher officials to the directorate, and to the loyalty of the whole staff throughout a very trying year.

EDINBURGH.

PRINCES STREET CONTROVERSY—ELECTRIFICATION PLANS.

A public inquiry is to be held in the city by the Ministry of Transport regarding the proposal of the Town Council to erect centre poles in Princes Street as part of the tramway electrification scheme. This statement was made by Mr. Arthur Neal, Parliamentary Secretary to the Ministry, to a deputation from the Cockburn Association which waited upon him in London on February 21 to oppose the Princes Street scheme on grounds of obstruction of traffic and public safety. A deputation from the Corporation had been received at the Ministry on February 14th with reference to the electrification of the tramways. The Tramways Committee have recommended that application be made to Parliament for powers to construct a tramway along George Street, connecting St. Andrew Square with the West End of the city, a route which would be parallel with Princes Street. The committee's decision is not a recommendation to proceed with the actual work of construction, but merely that a proposed clause should remain in the Provisional Order which is being promoted by the Corporation. The insertion of this clause is a precautionary measure that would avoid delay should the Town Council desire to proceed with the scheme. It was decided to delay consideration of Mr. Pilcher's report on the proposed electrification of the Northern routes until the committee had had an opportunity of receiving a deputation of the citizens resident in these districts who are desirous of the immediate electrification of the routes. Mr. Pilcher regards the electrification as too costly to be proceeded with immediately, and suggests that those routes should follow the electrification of the Portobello route. It was agreed to recommend an extension of the electric tramways from Nether Liberton to Liberton Dams, and a proposal to connect Portobello with the Leith system *via* Seafield Road was remitted to the manager for report. The Tramways Committee have considered the adoption of single-deck cars for use on certain routes, and the general manager was instructed to prepare a report and plans.

GLASGOW.

TRAMWAY PURCHASE CELEBRATED—ALL-NIGHT SERVICE—SUBWAY CLOSED—FOOTPATH RULE—ACCIDENT.

To mark the transference of the undertaking of the Airdrie and Coatbridge Tramways Company to Glasgow Corporation, a luncheon was given by Mr. P. N. Gray, a director of the tramways company. Among those present were—Provost Lavelle, Coatbridge; Provost Kennedy, Airdrie; Mr. James Dalrymple, general manager, Glasgow Corporation Tramways; Baile M'Whirr, convener, and Bailie Laing, sub-convener, of Glasgow Tramways Committee; and Mr. Archibald Robertson, ex-manager of the Airdrie and Coatbridge Tramways. At Coatbridge later in the day, Mr. Robertson, who has been general manager of the Tramways Company for 12 years, was presented by the staff with an inscribed silver rose bowl.—A report on the city's all-night service presented by the general manager showed a deficiency on the first year's working of £1,098. The subway was closed on Sunday, February 19, until further notice, owing to the revenue being insufficient to meet the expenditure. The subway was opened 25 years ago. It was at first successful, but the competition of the Corporation electric tramways reduced the traffic receipts, and in recent years the company has been unable to pay more than a small instalment of the interest on the preference capital, while last year there was a deficit of £15,000. The issued capital consists of £1,250,000 in preference and ordinary shares. A full account of the undertaking was published in the TRAMWAY AND RAILWAY WORLD of August, 1897. The magistrates, after having received a recommendation from the Tramways Committee, have decided to adopt the "Keep to the Left" rule of the footpath. Notices bearing this injunction are affixed to the lamp posts and inside the tramway cars. On February 8, a tramcar which had got out of control, traversed the full length of High Street, where there is a fairly steep gradient. In its course the car collided first with a lorry, then with a motor van, and finally with another lorry, which brought it to a standstill. The motorman was thrown out in the first collision. About 12 people were injured.

MANCHESTER.

MOTORMAN'S PLUCK—TRACK DOUBLING—1919 AGREEMENT.

A Corporation tramcar driver, Harry Ashworth, received an injury to his stomach by being flung against the controller when his car collided with a lorry. He remained at his post, and after a short delay drove the car to the depot. He arrived there in great pain and was removed to hospital where it was found he had sustained internal injuries. The Tramways Committee are applying to the

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Ministry of Transport for sanction for the doubling of the tramway track over the canal bridge in Hulme Hall Lane, and in Stanley Grove. The tramway employees have passed a resolution strongly resenting any revision of the 1919 Agreement that has for its object "a retrogressive step," and pledged their utmost support to the Executive Council in any action they may deem necessary to resist a violation of the principle of the Agreement. [A reference to the retirement of Mr. J. M. McElroy (general manager of the Corporation Tramways) will be found elsewhere in this issue.]

NORTH WALES.

LLANDUDNO AND COLWYN BAY TRAMWAY STRIKE.

The employees of the Llandudno and Colwyn Bay Electric Railway Company went on strike on Saturday, February 18, as a protest against the proposal of the company to make a reduction of 1s. per week in their wages in addition to the automatic decrease under the national sliding scale. Mr. Alex. G. Balfour (general manager of the company) stated that he placed the proposed reduction before the men at a meeting on February 15, when it was accepted by them. He understood that the men afterwards received some communication which seemed to have unsettled them, and the strike, without notice, was decided upon on the following Friday night. The men having left their work without notice, they had all been discharged from the company's service. Mr. Balfour pointed out that the wages and bonus of the employees had always been on a lower scale than those of the larger tramway undertakings, as the traffic is, in the main, of a seasonal nature. Mr. Balfour denied that there was any breach of an award on his part. Motor omnibuses have done good business in the absence of the tramcars.

SOUTHAMPTON.

TRAMWAYS EXTENSION.

The Swaythling tramway extension of the Corporation tramways, which consists of 3 furlongs 8·80 chains of double track, was inspected by Major Hall, of the Ministry of Transport, on February 20, and was opened for service on February 23. In addition to the Swaythling extension, a line was completed during the last few months to Millbrook. This line consists of 1 furlong 2·86 chains of double track, and 4 furlongs 2·42 chains of single track. The whole of the work has been carried out by the tramway department under the supervision of Mr. J. Dobson, general manager and engineer.

NEWCASTLE TRAMWAY STRIKE.

DISPUTE OVER THE 48-HOUR WEEK.

The operating staff of the Newcastle-upon-Tyne Corporation Tramways ceased work on Monday, February 27, and since that date up to the date of this issue the city has been without a car service. The Corporation's omnibuses have also been involved, and the public have had to rely upon private coaches, omnibuses, brakes, etc., for which the Watch Committee granted additional temporary licences.

The employees ceased work rather than consent to the Transport and Electricity Committee's decision to increase the working week from 44 to 48 hours. It will be remembered that following the decision of the City Council in December last to rescind a former resolution restricting the hours of municipal employees to 44 per week, the Transport and Electricity Committee on January 26 resolved to bring the tramway working hours into line with those fixed under the National Agreement of March 1919. The employees strongly resented this, and negotiated with the committee in the hope either of persuading them to nullify the increase or to grant a proportionate advance of pay. The committee, however, at first declined to accept the men's proposals, and reminded them that the increase in working hours was necessitated by the financial position of the undertaking. Not only would it mean a considerable reduction in expenditure, chiefly by obviating overtime, but would make possible a later car service. A sub-committee of the Transport and Electricity Committee on Sunday, February 26, issued a statement in which they remarked that, during the negotiations, representatives of the men asserted that the conditions asked for were equal to 8s. per week. This contention was not accepted by the committee, who, while maintaining their claim that the 48 hours' week should be worked in harmony with other tramway undertakings, recognised that the amount of wages now earned by motormen and conductors was slightly less than wages paid in other comparable towns, and offered to give an additional 1s. 6d. per week, exclusive of merit pay, which would have corrected this deficiency. Other advantages and improvements in conditions of working were in the course of negotiations amicably arranged for submission to the men. In accordance with a resolution of the Council, the increase of the working hours would not have involved any dismissals. "In view of the proposals agreed to by both parties for submission to the men having been rejected," the statement concluded, "these are now withdrawn. The depots will be open to-morrow (Monday) morning as usual for any men who care to report for duty, but the present rates of pay will operate for a 48-hours week."

ALDERMAN MAYNE'S STATEMENT.

Alderman R. Mayne (chairman of the Transport and Electricity Committee), addressing the City Council on March 1, said the committee had taken no steps to organise a service because they hoped that the men, after reflection, would realise they had made a mistake in refusing to accept an offer which, taken as a whole, was an improvement on the provisions of the National Agreement. "I deliberately assert," he added, "that the proposed settlement would have put Newcastle tramwaymen on terms and conditions equal to or above the average of Leeds, Manchester, Salford, Birmingham, Halifax, Cardiff, Nottingham, Hull, and Sunderland."

The employees held a ballot on March 8 to decide upon acceptance or rejection of the sub-committee's terms. These, according to a subsequent statement by the Lord Mayor, include a 48-hour week with union conditions, a wage of 67s., uniform, guaranteed employment, and eight days' holiday with pay. The terms were rejected by a majority of 832; only 90 employees voted for acceptance, and 46 men did not vote.

At a meeting of the Transport and Electricity Committee, held the following day, Alderman Mayne made a statement as to the negotiations that had taken place, and indicated the course that the committee proposed to adopt in view of the ballot. After discussion, a resolution was passed, with only one dissentient, fully endorsing the action of the sub-committee and maintaining the decision to adopt a 48-hour working week fixed by the National Joint Industrial Council. The committee stated that the men are at liberty to resume work at any time on the conditions laid down. The Corporation requested the men on strike to hand in their uniforms on March 14, but this the men declined to do, contending that this would mean the cancellation of their agreement with the Corporation.

THE FOUNDATION COMPANY, LTD.

AN IMPORTANT ORGANISATION WITH INTERNATIONAL CONNECTIONS.

This company, whose offices are at 83 Kingsway, London, W.C.2, has acquired the goodwill of the Foundation Company of New York in Great Britain and the British Dominions other than Canada. Mr. Walter Rutherford is the managing director, and the other members of the Board are—Mr. A. W. Tait, C.B.E. (chairman), Mr. Franklin Remington, U.S.A. (deputy chairman), Lt.-Col. Fred W. Abbot, Sir Charles Davidson, and Mr. John Doty.

The staff organisation is as follows—Engineer-in-chief, Mr. John W. Doty, C.E., M.Am.Soc.C.E.; general manager and chief engineer, Mr. H. E. Midgley, M.A. (Cantab), M.Inst.C.E., M.Inst.E.E., M.I.Mech.E.; commercial manager (home), Mr. Douglas Kerr, M.A. (Cantab); commercial manager (export), Mr. A. A. Vanneck; estimating engineer, Mr. H. W. Kimber, M.I.Mech.E.; abstract engineer, Mr. A. Paterson, M.I.Mech.E.

The organisation thus includes a number of well-known men who have been associated with many representative construction undertakings in this country and abroad. The principal executive officers have had wide and varied experience in the construction and equipment of railways, tramways, generating stations, etc., and the company will carry on business as engineers and contractors. The experience placed at its disposal by the American company covers a variety of constructional work, including industrial plants, power plants, hydro-electric developments, railways, tunnels, bridges, highways, etc. The American company has similar associated companies or branch offices in Canada, Mexico, and South America, and in France and Spain, and there will be a close association and continuous exchange of information between the English company and the several other companies, as well as with the American company in New York.

INQUIRY INTO DIVERTED TRAFFIC.

The Association of British Chambers of Commerce and other organisations of traders are making a joint inquiry among their members as to the extent to which they have diverted traffic from railways to road transport on account of the high rates of the former. It is sought to discover how much of the diverted traffic would return to the companies if rates were materially reduced, and what increased tonnage would be sent by rail on other grounds. A material feature of the inquiry is an attempt to discover how much prices of commodities which ought to be sent by rail are now above pre-war values, and what percentage of reduction in rates is necessary to assist new business. The results of the inquiry will be communicated to the railway companies.

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CONTRACTS AND ORDERS.

St. Helens Tramways Committee have authorised their Motor Car Sub-committee to purchase a light motor car.

Douglas (I.O.M.) Town Council have decided to purchase a double-deck 48-seater Tilling-Stevens motor omnibus at £1,700.

Bournemouth Tramways Committee have accepted the tender of Walter Scott, Limited, for 220 tons of new rails at £13 17s. 6d. per ton.

Yarmouth Tramways Committee are obtaining a No. 1 "Celerity" Rail Grinder from the Equipment and Engineering Company at a cost of £112 8s.

The British Insulated and Helsby Cables, Limited, are to supply 1,000 66-in. copper rail bonds at a price of 3s. 7½d. each to Bradford Tramways Committee.

The Takata Company, of Japan, has ordered another large turbine-generator for one of its new plants from the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa.

The English Electric Company, Limited, has received an order from Preston Corporation Tramways Committee for covering in the fronts of the five remaining uncovered tramway cars.

Bolton Tramways Committee have recommended acceptance of the tender of the Equipment and Engineering Company (London) for a rail grinder and a welder for use on the tramway track.

Leyton Corporation have been recommended to accept the tender of the Brush Electrical Engineering Company for the supply of a charging motor generator for the electric vehicle garage at £410 5s.

L.C.C. Tramways Special Track Work.—The continuance for a further period of 12 months of the arrangement between the London County Council and Hadfields, Limited, for the supply of special track work has been sanctioned.

The General Electric Company, Limited, in addition to the large order for the electrical equipment of the Brighton Railway Company, have in hand contracts for generating plant for China and India, including one for the Bombay and Baroda Railway.

Burnley Tramways Committee have recommended acceptance of the following tenders—Walter Scott, Limited, Leeds, 200 tons of Titanium-treated steel rails, at £12 5s. per ton; Thermit, Limited, London, welding of 400 joints on terms mentioned in their tender.

Leeds Corporation Tramways Committee have accepted the following tenders—One mile of circular trolley wire, Tramway Supplies, Limited; 45-H.P. motor for the Kirkstall Road depot, J. W. Hinchliffe; ten partial electrical equipments for tramway cars, the English Electric Company, Limited.

Straker-Squire, Limited, of Edmonton, London, N., have received a repeat order from the Leigh Corporation for six single-deck omnibuses of the "A" type, the bodies to have front and rear entrances. This Corporation are already running six Straker-Squire omnibuses in Lancashire.

The Electro-Mechanical Brake Company, Limited, of West Bromwich, have received an order through the English Electric Company, Limited, for 75 car sets, and through the Metropolitan-Vickers Electrical Company, Limited, for 50 car sets of E.M.B. unbreakable resistances required for the 60-H.P. equipments of the new London County Council cars.

Ayr Town Council have accepted the following tenders for laying a double tramway track in Prestwick Road and five passing places—Alexander Stark and Sons, Limited, at £12,201; Hadfields, Limited, for about 1,350 tie bars at 2s. 10d. each; Thermit, Limited, to do the Thermit welding required at 30s. per joint (probably 240 joints) plus wages of the welder at £4 10s. per week.

Hull Corporation Tramways Committee have accepted the tender of Walter Scott, Limited, Leeds, for 1,000 tons of steel rails at £12 per ton, plus certain additional charges in connection with Sandberg's patent sorbitic treatment. The committee decided not to consider any offers from Germany. The lowest German tender was £11 15s., with £1 per ton for special treatment.

The Bradford Tramways Committee have ordered from Cole, Marchent and Morley, Limited, 20 tons of cast-iron track brake blocks at 9s. 3d. per cwt., and 20 tons of scrap brake blocks; from Messrs. T. H. Newsome and Company, 1,000 gallons of heavy lubricating oil at 2s. per gallon; from E. Brooksbank and Company, Limited, 2,500 gallons of machinery lubricating oil at 1s. 10d. per gallon; and from H. Summersgill, iron castings at 34s. per cwt.

Halifax Tramways Committee have accepted tenders as follows—Alexander McBean & Son, Wolverhampton, for 100 tons of rails, at £12 14s. per ton, and 4 tons of fish plates at £16 10s. per ton; Metropolitan-Vickers Electrical Company, Manchester, for two spare armatures, at £95 each; the English Electric Company, Limited, for the supply of three controllers at £55 each. The committee have referred tenders for a single-deck omnibus to a sub-committee, with power to act.

PERSONAL.

Mr. A. Nicklin has been appointed electrical and mechanical engineer of Swindon Corporation at a commencing salary of £500 per annum.

Mr. F. Bunney, an inspector at Westminster station, who is in his 70th year, retired on February 28, after serving nearly 42 years with the Metropolitan District Railway.

Mr. W. H. Alabaster, city electrical engineer of Melbourne, has been authorised by the City Council to visit this country to inquire into electrical matters, new machinery, etc.

Lieut.-Col. D. J. Smith, O.B.E., has been unanimously elected president of the Institution of Automobile Engineers for the Session 1922-23, and Messrs. H. G. Burford and L. H. Hounsfield, vice-presidents.

Mr. A. E. Wray, formerly of Dick, Kerr and Company, Limited, and subsequently of the English Electric Company, Limited, has joined the staff of G. D. Peters and Company, Limited, 3a, Dean's Yard, London, S.W.1.

Mr. H. H. Gordon, who for many years has been a member of the Highways Committee of the London County Council, and has taken particular interest in tramway matters, did not stand at the triennial election of the Council on March 2.

Mr. J. A. S. Wood, assistant manager of Manchester Corporation Tramways, is about to retire on superannuation. He has been in the service of Manchester Corporation for about 45 years, and has occupied his present position for eight years.

Mr. James Makin, chief electrical engineer to the Bexley Urban District Council, and engineer and general manager of the Bexley Tramways and Dartford Light Railways joint undertaking, has been appointed chief electrical engineer to the city of Hereford.

Sir John Timpson, K.B.E., K.S.T., O.R.S., was entertained at luncheon at the Hotel Russell on February 10 by the Executive Council of the Municipal Tramways Association, of which he is vice-president. Alderman R. Mayne, of Newcastle, president of the Association, was in the chair, and all members of the Council were present, with the exception of one or two who were unavoidably detained. The company gathered to express to Sir John their gratification at the honour lately conferred upon him, and the remarks of Mr. Mayne and other speakers testified to the high esteem and affectionate regard in which he is held by his colleagues. Sir John has had a long and distinguished municipal career at Portsmouth; in fact there is scarcely a department of municipal activity in which he has not borne a useful part. As chairman of the Tramways Committee for many years he has been largely instrumental in the development of that undertaking. Thrice mayor of Portsmouth during the crucial years of the war, his services to the country in receiving foreign representatives, and in many other activities, have indeed well merited a knighthood of the British Empire.

On February 17 Sir John was the guest at dinner of the Metropolitan Municipal Tramway Managers and some personal friends at the Sports Club, St. James' Square, London, S.W. Mr. A. L. C. Fell, C.B.E., general manager of the London County Council Tramways, was in the chair, and among those present were Sir John W. Courtis, Col. Sir T. A. Polson, M.P., the Rt. Hon. G. H. Roberts, M.P., Messrs. G. K. Bruce, T. B. Goodyer, L. E. Harvey, W. Murray, W. R. Spaven, L. Slattery, W. C. Ullmann, J. C. Williams, J. Beckett, and A. Ellis.

We regret to record the death of **Mr. Wm. E. Kenway** at the age of 77 years. Mr. Kenway was formerly many years general manager of the Birmingham and Midland Tramways.

Alderman E. H. Sellers, J.P., who for nearly seven years has been chairman of the Huddersfield Corporation Tramways Committee, died on March 1 after a short illness. Alderman Sellers, who was 68 years of age, entered the Town Council in 1907, and was appointed to the Tramways Committee in 1908. In 1915 he was elected deputy chairman of the committee and a few months later was appointed chairman. He took the deepest interest in all matters connected with the tramways department. His magnetic personality made him highly esteemed by every member of the staff, and the department owes much to his unfailing diplomacy and shrewdness. Alderman Sellers was a member of the Executive Council of the Municipal Tramways Association and devoted much of his time to national tramway problems.

Return Fares in South London.—The South Metropolitan Electric Tramways on March 8 introduced cheap return fares on the Croydon-Sutton and Croydon-Tooting routes, as follows—All 4d. ordinary single fares, 7d. return; 5d. single fares, 8d. return; 6d. single fares, 10d. return.

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TRAMWAY MANAGERS' RESIGNATIONS.

Mr. J. M. McElroy, general manager of Manchester Corporation Tramways, has tendered to the committee his resignation, which they have accepted with regret. Mr. McElroy has long suffered from ill-health, and it has been known for some time that he intended to retire. His withdrawal from active life will be received with great regret throughout the tramway industry, whose interests he has done so much to advance. Mr. McElroy entered the service of the Manchester Highways Department as a youth in 1880, when horse-drawn cars, owned by a private company, were in use. About 15 years later, when he had become principal assistant in the department, and preparations were being made for municipalisation of the tramways, he was transferred to the Tramways Department and became secretary and adviser to the new committee. In 1901 he was appointed general manager of the undertaking, and has held the office with a distinction and ability which have won him a reputation not only in Manchester but throughout the country as an expert on tramway matters. Mr. McElroy has been a member of the Executive Council of the Municipal Tramways Association since its inception, and was president in the year 1906-7. He has studied the transport undertakings of several cities in Europe and the United States, and his report to the Corporation in 1914 on traffic problems attracted considerable attention. Mr. McElroy frequently acted in an advisory capacity to other tramway authorities, and had served as an arbitrator on behalf of the Board of Trade, in tramway disputes. On the Joint Industrial Council he represented the Lancashire and Cheshire area. During the war Mr. McElroy served the Government in the Departments of the Admiralty, the Board of Trade, and the Ministry of Munitions. It is understood it will be some months before Mr. McFlroy's resignation takes effect.

Mr. Ernest Hatton has tendered his resignation to the Transport and Electricity Committee of Newcastle-on-Tyne as general manager and engineer of the City's tramways. Mr. Hatton's health has for a long time not been good, and he has decided to take a long rest. Mr. Hatton's withdrawal from the position he has so ably filled for 17 years will be a great loss to Newcastle. When he came from Salford the Newcastle tramways were in a very unsatisfactory position, but under his management they soon became a profitable undertaking, and they have contributed considerable sums to the relief of rates. The system has been extended under his direction, and prior to the comparatively recent rearrangement of fare stages the fares were among the lowest in the country. Owing to the position of Newcastle, the maintenance of the service during the war involved exceptional difficulties. The staff was, of course, greatly depleted, and Mr. Hatton organised a scheme of volunteer drivers and conductors to assist in carrying the thousands of munition workers to the factories and home again in the evening. Mr. Hatton's abilities are appreciated throughout the tramway field, and only recently his advice was sought by some continental tramway undertakings in connection with plans for handling large volumes of traffic at holiday times, which has been a feature of the Newcastle management. The Corporation Transport and Electricity Committee received Mr. Hatton's resignation with regret, and places on record their high appreciation of his services. It was decided to advertise for a successor.

Mr. J. W. Hame, having resigned the position of electricity engineer and tramways manager of York Corporation, the Council propose to appoint a whole time electricity engineer and also a whole time tramways manager, preferably an engineer. The salary of the former position will be £650, and of the second £600 per annum. Mr. E. J. Nicholls has been recommended for the city electrical engineer.

Alderman Sir William E. Clegg, J.P., chairman of Sheffield Corporation Tramways and Motors Committee, is to receive the Freedom of the city on April 21 next, to mark his 70th birthday. It is chiefly in connection with the development of the tramways that Sir William's great work for Sheffield is known. He was first appointed chairman of the Tramways Committee when that body was formed in 1896, on the acquisition of the tramway system by the municipality, and it is largely owing to his foresight and ability that the undertaking has developed to its present state of efficiency. Under his chairmanship motor omnibuses were introduced, and their operation has proved popular and successful. Sir William filled the office of Lord Mayor in 1898. In 1902 he was elected chairman of the Education Committee, and since the inception of Sheffield University he has represented the Sheffield Education Committee on the University Council. In 1912 he received from the University the honorary degree of LL.D., and in 1918 was made a C.B.E. in recognition of his work as chairman of the local munitions committee.

Mr. Charles I. Baker, who for the past 12 years has been traffic superintendent to the Blackpool Corporation Tramways, has been appointed tramways manager to the Ashton-under-Lyne Corporation in succession to the late Mr. Ernest Holt.

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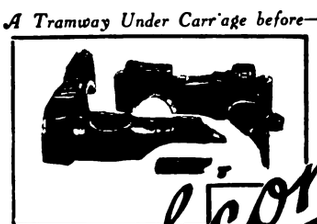

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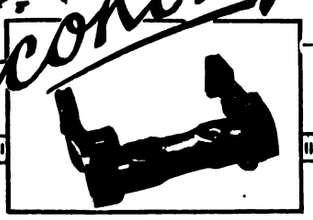

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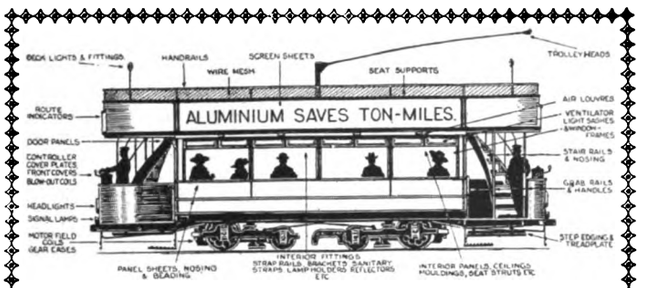

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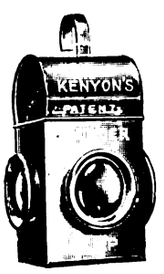

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

Applications for Letters Patent.

The number of the patent is given in brackets.

Control gear for electric driving mechanism (4,053)—Associated Equipment Company, Limited, and C. K. Edwards.
Brakes for front, etc., steering wheels of motor vehicles (4,018)—H. Chandler and H. P. Girling.
Variable speed gears for motor vehicles (3,789)—J. H. Dolton.
Live rails in systems of electric traction (3,701)—G. Ellson and S.E. and L.C. & D. Railway Companies' Managing Committee.
Motor vehicle (3,542)—H. Grade.
Gear arrangement for motor vehicles (3,543)—H. Grade.
Control of electrically-propelled vehicles (4,718)—C. F. Barnholdt and the English Electric Company, Limited.
Motor vehicles (4,308)—L. M. Bernon and A. E. L. Morelle.
Lamp fittings for self-propelled vehicles (4,582)—British Thomson-Houston Company, Limited, and L. Griffiths.
Two-speed gear and clutch for motor vehicles (4,558)—J. F. Farris.
Motor vehicles (4,189)—A. J. McDonald.
Variable speed gears for motor vehicles (4,665)—S. D. Marchant.
Locking device for brake levers of motor vehicles (4,425)—J. Mercer.
Sand pipe adjuster for electric cars (4,557)—J. Reid.
Radiators for internal combustion engines (4,220)—H. P. Saunderson.
Gear changing mechanism for motor vehicles (4,724)—F. Shaw.
Motor vehicles (4,531)—A. Thomas.
Trackless trolley vehicles (5,392)—G. N. Cadbury and A. W. Maley
Tramway trolley head (4,992)—A. Challinor.
Variable speed gears for motor vehicles (5,185)—W. H. Facon.
Direction indicators for road vehicles (5,186)—J. Florendine.
Tramway rails (5,013)—L. R. Moir and G. H. Walker.
Jacking appliances for vehicles (5,656)—E. M. Scott and H. C. Tuck.
Electrically-controlled direction indicators (5,085)—F. H. Watts.
Brake mechanism (6,145)—G. L. Atkinson.
Trolley wheels for electric tramways (6,258)—P. P. Berthet.
Electric railway signal repeating system (6,113)—J. Bethenod.
Route indicator for vehicles (5,717)—J. Brailsford and F. Neimeyer.
Bodies for motor vehicles (6,459)—M. A. Buch.
Splash guard for road vehicles and tramcars (6,196)—G. Caddick.
System for road traffic control (5,858)—C. H. Campbell.
Tram rails (6,388)—E. J. Flynn.
Brake blocks, electric collector shoes, etc., for railway vehicles (6,179)—R. P. Foster and J. W. Taylor.
Motor vehicles (6,433)—R. T. Glascodine and Spencer, Moulton and Company, Limited.
Turnstiles for registering and checking passengers (6,367)—London Electric Railway Company and J. P. Thomas.
Motor vehicles (5,680)—H. J. Playford.
Variable speed gears for motor vehicles (5,840)—W. O. Spinks.
Friction gearing for motor vehicles (5,992)—H. Tasker.
Means for supporting and insulating conductors of electric overhead distribution (6,205)—G. V. Twiss.
Steering gear for motor vehicles (6,299)—R. J. Urquhart.
Motor vehicles (6,300)—R. J. Urquhart.
Means for sanding rails of tramway tracks (5,720)—A. Wheatcroft.
Trailer connection and gap guard for traction (6,040)—V. H. Whiteman.
Slack adjusters for connecting links for car-couplers (5,953)—J. Willison.
Traffic signal for vehicles (6,022)—R. J. Woods.
Striding motion driving gear for motor vehicles (6,443)—V. Zboril.

Specifications Published

1920.

Steering devices for motor vehicles (20,767—*148,946*)—Drake Manufacturing Company.
Change speed gears for motor vehicles (23,562—*173,812*)—S. de Santis.
Ground levers for tramway points (28,398—*173,857*)—H. A. Thomson.
Electrical contact makers for use with the steering wheels of motor vehicles (28,681—*173,878*)—J. L. Scott.
Chassis for motor road vehicles (30,828—*173,928*)—F. Mills.
Axles of motor road vehicles (33,243—*173,947*)—F. J. Mitchell.
Brake blocks with removable brake surfaces (20,594—*148,856*)—K. Fleischer.
Rear axle drive for motor vehicles (21,080—*151,921*)—E. Rumpler.
Car trucks (24,672—*174,110*)—S. B. Brilhart.
Lifting jacks (26,566—*174,123*)—W. Williams and S. R. Fairclough.
Brake for motor vehicles (31,277—*174,232*)—F. Winterbottom.
Safety controlling gear for electrically-propelled vehicles (35,438—*174,512*)—R. Garrett and Sons, Limited, and A. J. Serve.
Brakes for electric tramcars (32,747—*174,795*)—C. J. Spencer.

1921.

Steering gear of motor vehicles (2,287—*174,281*)—T. Ramage.
Driving mechanism for the rear axle (27,105—*170,295*)—E. Rumpler.
Rear axle drive for motor vehicles (27,106—*170,296*)—E. Rumpler.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Feb. 12	Feb. 19	Feb. 26	Mar. 5		1922. WEEKS ENDED Feb. 11	Feb. 18	Feb. 25	Mar. 4		AGGREGATE. Wks.	1921-22.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,421	3,480	3,382	3,601	...	3,046	3,182	3,288	3,397	...	39 2/7	139,603	− 12,295
Aberdeen Motor Buses	55	60	57	67	...	142	133	131	153	...	39 2/7	9,315	+ 8,119
Ayr Corporation	537	548	538	544	...	460	475	477	503	...	42	29,997	− 2,195
Barrow Corporation	854	862	847	874	...	612	606	651	653	...	48	39,552	− 3,812
Belfast City Tramways	10,902	11,156	11,168	12,007	...	11,852	11,401	11,580	12,277	...	48	601,221	+ 51,527
Birkenhead Corporation	2,518	2,573	2,593	2,564	...	2,373	2,469	2,562	2,618	...	47 2/7	125,820	− 13,170
Birkenhead Motor 'Buses	361	365	384	370	...	466	519	532	592	...	47 2/7	31,910	+ 12,049
Birmingham Corporation	31,911	32,381	32,057	31,657	...	27,182	27,806	28,982	28,883	...	48	1,404,089	− 126,171
Birmingham Motor 'Buses	1,808	1,870	2,310	2,284	...	1,644	1,683	1,786	1,931	...	48	94,398	− 2,574
Blackburn Corporation	2,328	2,404	2,465	2,409	...	2,094	2,043	2,202	2,158	...	48 2/7	114,664	− 10,837
Bradford Corporation	13,761	14,859	13,644	13,926	...	12,909	13,175	13,878	13,948	...	48	658,575	+ 10,034
Burnley Corporation	3,516	3,426	3,498	3,606	...	3,257	2,996	3,304	3,196	...	—	—	—
Burton-on-Trent Corporation ...	593	596	605	615	...	560	557	597	590	...	48	29,985	+ 392
Bury Corporation	2,384	2,385	2,531	2,451	...	2,211	2,159	2,288	2,285	...	48 2/7	116,901	− 5,524
Chatham and District	1,432	1,511	1,592	1,581	...	1,357	1,466	1,444	1 544	...	9	12,607	− 1,553
Chesterfield Corporation	623	634	618	628	...	571	559	556	554	...	48	28,017	− 745
Chesterfield Motor Buses	863	880	860	854	...	660	683	690	696	...	48	36,222	− 2,690
Derby Corporation	2,154	2,308	2,391	2,295	...	1,927	2,024	2,078	2,089	...	48	103,337	− 7,544
Dundee City	3,186	3,150	3,063	3,068	...	2,940	2,932	2,889	2,998	...	41 2/7	132,163	+ 4,949
East Ham Corporation	2,019	2,019	2,140	2,107	...	2,000	2,092	2,134	2,206	...	48 2/7	102,156	+ 2,225
Edinburgh Corporation	...	...	...	...	...	10,701	10,888	11,720	11,696	...	42	528,046	+ 4,074
Edinburgh Motor 'Buses	...	...	...	...	...	3,075	3,154	3,409	3,319	...	42	148,795	—
Glasgow Corporation	44,811	45,837	45,167	45,903	...	42,912	43,935	43,480	45,343	...	39 4/7	1,786,193	+ 1,432
Glossop (Urban Elec. Supply Co.)...	225	220	224	230	...	214	238	229	231	...	9	2,064	− 43
Halifax Corporation	4,234	4,362	4,215	4,395	...	3,719	3,642	3,709	4,101	...	46 4/7	204,210	− 379
Halifax Motor 'Buses	111	110	106	115	...	67	64	61	71	...	46 4/7	5,666	− 1,680
Halifax Railless Cars	...	...	...	...	...	40	38	43	42	...	32	1,686	—
Huddersfield Corporation	5.177	5.207	5.265	5.240	...	4.701	4.640	5.083	5.205	...	49	253.575	+ 8.115
Ilford U.D. Council	1.253	1.328	1.397	1.378	...	1.388	1,388	1,452	1.503	...	48 2/7	72,282	+ 9.930
Ipswich Corporation	766	788	820	820	...	678	707	726	779	...	48	41,141	− 5,144
Isle of Thanet...	487	481	539	560	...	467	506	520	590	...	21	13,216	+ 1,096
Kilmarnock Corporation	356	357	376	374	...	323	317	330	325	...	41 2/7	14,972	− 535
Leicester Corporation	6,448	6,215	6,346	6,550	...	6,863	7,044	7,211	7,615	...	9	64,228	+ 5,847
Liverpool Corporation	25,956	26,208	29,084	29,958	...	26,960	27,644	28,983	29,438	...	9	257,376	+ 11,238
London County Council	97,529	98,410	99,693	100,867	...	88,751	89,255	90,826	96,437	...	48	4,677,496	+ 196,569
Maidstone Corporation	386	401	413	416	...	354	374	372	395	...	47	22,498	− 572
Manchester Corporation	37,632	37,699	38,758	38,100	...	35,786	36,298	37,507	37,395	...	48	1,858,137	+ 181,630
Newcastle-on-Tyne Corporation ..	11,344	11,234	11,299	11,306	...	10,415	10,426	10,647	*Strike*	...	48	526,492	− 6,867
Nottingham Corporation	7,204	7,452	7,321	7,451	...	7,194	7,311	7,432	7,623	...	48	329,905	− 40,843
Oldham Corporation	4,485	4,690	4,754	4,408	...	4,422	4,313	4,480	4,562	...	50	234,112	+ 2,570
Preston Corporation	1,827	1,843	1,803	1,866	...	1,732	1,715	1,722	1,857	...	47 4/7	90,974	+ 3,224
Preston Motor 'Buses	...	...	...	...	...	137	125	133	133	...	5 2/7	720	—
Reading Corporation	1,455	1,540	1,496	1,513	...	1,392	1,423	1,478	1,509	...	48	75,634	− 3,749
Reading Motor 'Buses	234	259	259	255	...	277	280	300	326	...	48	16,176	+ 3,496
Rotherham Corporation	2,750	2,747	2,703	2,707	...	2,242	2,162	2,188	2,210	...	47	106,296	− 19,635
St. Helens Corporation	2,044	2,088	2,032	2,098	...	1,550	1,515	1,582	1,649	...	48	85,070	− 14,994
Salford Tramways	10,558	10,551	11,353	10,420	...	9,954	9,933	10,838	10,294	...	47 3/7	514,676	+ 20,893
Sheffield Corporation...	20,542	20,399	20,318	20,019	...	17,970	18,238	18,499	18,754	...	48 3/7	935,837	− 71,742
Southampton Corporation	2,905	2,923	2,977	2,929	...	2,882	2,788	2,783	2,871	...	48	141,714	− 9,101
Southampton Motor 'Buses	182	181	189	184	...	100	93	94	97	...	48	7,190	− 4,421
Southend Corporation	1,525	1,589	1,691	1,682	...	1,730	1,773	1,814	1,973	...	48	117,675	+ 7,721
South Shields Corporation	1,854	1,871	1,862	...	...	1,588	1,633	1,672	...	...	48	80,240	− 11,122
Sunderland Corporation	2,727	2,789	2,816	2,757	...	2,370	2,469	2,524	2,578	...	48	125,454	− 21,391
Swindon Corporation	340	368	355	366	...	313	326	316	348	...	47 4/7	18,644	+ 127
Tyneside Tramways and Tramroads	1,108	1,181	1,145	1,156	...	842	865	860	806	...	9	7,008	− 2,936
Wallasey Corporation	2,527	2,553	2,560	2,560	...	2,294	2,353	2,498	2,583	...	48 3/7	133,626	+ 7,037
Wallasey Motor 'Buses	122	130	133	136	...	193	175	217	196	...	48 3/7	11,312	+ 3,115
Walsall Corporation	1,853	1,913	1,904	1,862	...	1,563	1,606	1,680	1,673	...	48	79,007	− 8,807
Walsall Motor 'Buses	1,316	1,287	1,257	1,274	...	883	898	958	944	...	48	45,064	− 12,138
Walthamstow U.D. Council	1,779	1,815	1,926	1,889	...	1,622	1,679	1,722	1,751	...	48 3/7	97,048	− 879
Warrington Corporation	1,028	1,038	1,026	1,098	...	993	980	1,003	1,044	...	48	47,933	− 495
West Ham Corporation	5,888	5,927	6,080	6,041	...	5,486	5,533	5,625	5,783	...	48	282,574	+ 2,221
Wolverhampton Corporation ...	2,245	2,203	2,240	2,340	...	2,127	2,185	2,290	2,342	...	49	113,966	− 4,262
Wolverhampton Motor 'Buses ...	618	590	629	610	...	621	640	664	666	...	49	32,025	+ 8,944

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Feb. 12	Feb. 19	Feb. 26	Mar. 5		1922. WEEKS ENDED Feb. 11	Feb. 18	Feb. 25	Mar. 4		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£			£	£
Underground Rlys. & L.G.O. Co. ...	...	...	...	227,359	...	204,433	208,250	214,665	230,155	...	9	1,879,724	− 170,037
London and Suburban Traction ...	...	...	...	50,164	...	44,092	45,430	47,421	49,245	...	9	406,943	− 36,676

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.	1921. WEEKS ENDED Feb. 12	Feb. 19	Feb. 26	Mar. 5		1922. WEEKS ENDED Feb. 11	Feb. 18	Feb. 25	Mar. 4		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	76,472	78.001	78.802	81.890	...	82,101	81.559	84.461	83.025	...	9	738.413	+ 21,943
Calcutta ... ... Rs.	* 159	* 3.288	*25.334	85.052	...	107.938	109.538	110.402	108.937	...	9	942,641	+ 457,791
Madras... ... ... Rs.	(2 weeks)	...	(2 weeks)	* 9.511	...	(2 weeks)	48.860	(2 weeks)	39.503	...	8	193,602	+ 145.893
Pernambuco	4.789	4,655	4.458	4,702	...	3.626	3,750	4,017	3,971	...	9	34,537	− 10,020

Companies issuing Monthly Statements only.

	1920. Sept.	Oct.	Nov.	Dec.	1921. Jan.	Feb.	1921. Sept.	Oct.	Nov.	Dec.	1922. Jan.	Feb.	Wks.	AGGREGATE. 1921-22.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4,192	4,442	4.810	4.601	5.342	...	4.231	4,682	5.137	4,762	5.565	...	40	45,852	+ 2,909
Brazilian Trac. Mlrs	12043000	1,344200	12199000	12600,000	12875000	...	14471000	15016000	14555000	15405000	15032000	...	4	15,032,000	+ 2,157,000
Brisbane	45,430	46.310	...	...	46.280	...	46,220	47.880	...	...	48.790	...	4	48.790	+ 2.510
British Columbia	$ 806.797	835,054	858.842	917.668	908.385	...	845,185	845.973	877.335	940.113	907,242	...	30	6.100.157	+ 174.401
Buenos Ayres L'c'z	53.603	57.619	56.746	68.857	61.111	53.952	55.873	58.492	58.056	63.381	61.198	55.227	34	460.044	+ 8.695
Burma	50.235	55.763	53.696	50.481	50.035	48.405	58.974	64.778	58.271	54.194	59.362	52.380	30	403,127	+ 45.959
Cape Town ...	23.699	...	25.628	29.768	...	...	25,755	26.839	27,004	31.521	30.289	...	—	—	—
Carthagena & H. ...	2.273	3.319	2.714	5.560	3.877	2,839	4.244	3.862	1,717	3,237	3.075	2,773	8	5.848	− 868
Cordoba	19.597	19.627	19.122	19,299	18,696	...	23.204	23.203	22.698	22.641	22,152	...	43	230.068	+ 32.934
East India ...	4,228	4.299	4.234	4.271	4.299	3,819	4.154	4.054	3.945	4,058	4,080	3.737	30	28.571	− 688
Kalgoorlie... ...	3.361	3.094	2.969	...	...	...	2.829	2.406	2,419	...	...	...	48	24.944	− 8.728
La Plata	5.656	6.310	5.573	...	6.506	*728	...	6.587	6.453	...	...	6,318	52	13.041	+ 5,806
Manila ...	$ 280.352	327.652	320,345	315.599	321.449	...	322,212	323.108	306.850	316.467	309.252	...	4	309.252	− 12,197
Monte Video ...	41.816	45.246	43.846	...	50.863	48,119	44,927	47,927	47.426	...	32,634	48,111	17	180,301	− 11,462
Para	23.174	26.772	24.273	24.253	24,231	...	22.225	25.548	23.147	22.660	22.966	...	9	45,626	− 2,858
Port Elizabeth ...	5.803	...	6.620	8.185	...	...	6.477	6,788	6,828	8.344	8.120	...	—	—	—
Rangoon ... Rs.	114,857	111.830	104.468	120,000	122,588	...	132,225	151,000	137.750	145.500	137,850	...	4	137,850	+ 15,292
Winnipeg ...	$ 426,647	444,899	477,957	...	506,229	...	417,174	441,315	477.880	...	507,047	...	4	507,047	+ 818

* Strike of Employees.

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Dear Sirs, 16.11.1921.
"I am rather pleased at the record made by your Chassis No. 15363, which was placed in service by us on 1st July, 1920, and which is now about to come in for overhaul.
This chassis has now covered a total of 60,500 miles without coming in for heavy repairs."
Yours faithfully,
(Sgd.) E. B. HUTCHINSON,
General Manager.

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BUILDERS OF LONDON'S BUSES

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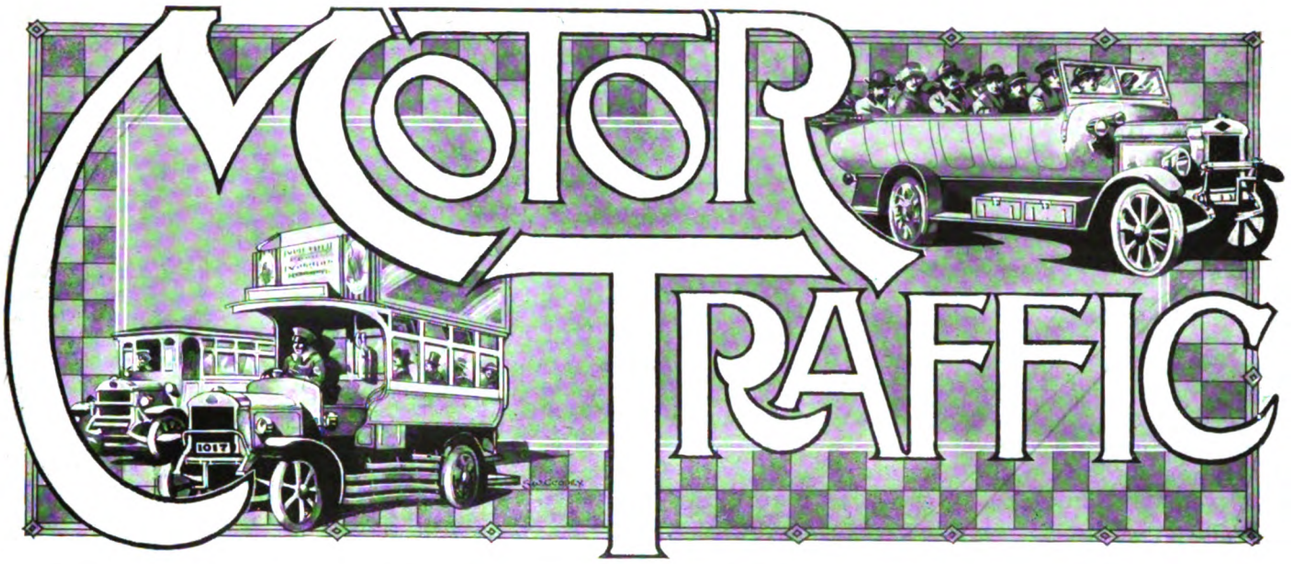

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

THE RAILWAYS' ROAD SERVICES.

Since this subject was last mentioned in these notes developments have been rapid. The railways directly concerned in the promotion of the Bills now before Parliament have shown themselves both astute and reasonable in dealing with prospective opposition. For the most part this opposition came originally from three quarters, namely, the general trading community, the municipalities, and the motor trade and using interests. As regards the first, the policy adopted by the railways has been mainly an educative programme. It has been pointed out to Chambers of Commerce and other kindred bodies that the proposals, if adopted, would not lead to the abolition of competition between rail and road, but rather to the accentuation of competition on the roads. Some road carriers have undoubtedly treated their customers in a rather casual manner, with the result that rates have been very variable, some traders being charged much less than others for comparable services. The railways point out that they will run their services on strictly business lines, that their rates will be limited, and that the trading community will thereby benefit. They maintain that they are willing to submit to safeguards which will not allow them to drive competition off the roads or to exploit the public by overcharging. The opposition of the municipalities has been based principally on the fear that the railways will operate passenger-carrying services in competition with municipally-owned trams and omnibuses, and therefore to the detriment of the ratepayer. This objection has been dealt with by an undertaking on behalf of the railways for a period of years not to seek powers to run road services other than for the carriage of goods. Motor users, so far as they operate services with which the railways propose to compete, naturally remain in opposition, and nothing in the way of a compromise can get over the fundamental fact that these people must suffer from the loss of any traffic that is transferred to the railways' services. Equally, the retail motor trader cannot be placated, because it is evident that the railways would never purchase vehicles through him, and neither would they use his services as a supplier of fuel and other commodities or for the purpose of maintaining or repairing their machines. The most that they can do in this direction they have already offered, inasmuch as they have given an undertaking not to use their own repair depots as public garages and not to sell supplies from them or to offer maintenance facilities to other vehicle owners. The opposition of the motor manufacturers was mainly due to the fear that the railways would build their own vehicles, and that, pending the completion of arrangements for manufacture, they might purchase secondhand vehicles declared surplus by the Government. In this case no new business would have come to the industry, and there would be nothing to compensate it for the loss of some at least of the business done with existing road carriers. These objections have been met by the offer of an undertaking on behalf of the railways not to manufacture vehicles themselves and to purchase only new vehicles, these to be for the most part of British origin. By taking these steps the companies have undoubtedly much weakened the opposition that they would otherwise have encountered, and so far as it is possible to forecast the fate of any Bill before Parliament, the probabilities are definitely in favour of the powers sought being granted. In that case a precedent will have been established upon which the other groups of railways will, no doubt, take prompt action.

INDIVIDUAL VEHICLE RECORDS.

Recently we drew attention to the benefits that the motor vehicle user can derive by keeping accurate records of performance of each vehicle singly, and we now understand that a very serious concerted effort is to be made by leading manufacturers to encourage this practice. The manufacturer has nothing to gain by persuading the user to keep records, unless the results of so doing are such as to reflect credit upon the manufacturer's product. If the records merely show that, let us say, his costly vehicle lasts no longer than another firm's cheaper machine, and costs just as much to run, or if they show that his machine, while cheaper, costs vastly more to operate and wears out far more quickly, he is bound to be a loser. If, then, the manufacturer presses the users to keep

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MOTOR TRAFFIC

records, it is because he has confidence in the merits of his own products. Probably his difficulty has been that because his machines were good they were necessarily not low priced, and that he has lost business because people persist in buying in what appears to be the cheaper market without taking full account of operating costs as well as of first cost. Carefully kept records are of great value from many points of view, but their main value is that they provide fair comparative data as between different types and makes of vehicle, and thus help the user to buy intelligently and to the best advantage. We trust therefore that readers will not turn a deaf ear towards the representations made to them, and will go to the trouble of systematically keeping records of a type that really affords a fair basis of comparison of different vehicles, thereby enabling them to effect numerous economies by intelligent selection and subsequently by the rapid detection of faults, the presence of which is revealed by the consequent falling off in the performance of the machine affected.

EXTRAORDINARY TRAFFIC.

By the dismissal in the House of Lords on February 21 of the appeal of H. Butt and Company, Limited, in the action by Weston-super-Mare Urban Council for damage alleged to be done to the road by steam wagon and trailer traffic of extraordinary weight, the question of extraordinary traffic has been left in a very unsatisfactory position. After five years of litigation, entailing a cost of nearly £14,000, it has now been decided that until new legislation has been enacted vehicle owners who put traffic on the road in such volume as to cause excessive damage through extraordinary weight must be held liable for the cost of repairing roads. If the judgment implied no more than this the outlook might be regarded as definite, but there is another consideration to be taken into account. It would appear from the judgment that haulage contractors are not liable for the cost of strengthening the foundations of a road so as to make it suitable for new traffic. It appears, moreover, that where the weight, although heavy, and the volume, although great, does not exceed reasonable limits, and the speed is not excessive, the owner of a vehicle is justified in assuming that main roads are strong enough for such traffic. The difficulty will be to discriminate between ordinary traffic and extraordinary traffic. In the case of the former there can be no claim for damage, but at a certain point ordinary traffic may become extraordinary, and at that point the vehicle owner may become liable. In such circumstances inconsistent decisions may be given in the several courts. Thus the decision of the House of Lords cannot be regarded as satisfactory, either to the road authority or to the transport industry. The Motor Legislation Committee and other bodies interested will in the circumstances no doubt press for an alteration of the existing law.

RAILLESS CARS FOR LONDON.—The Court of Referees of the House of Commons have decided that a *prima facie* case has not been made out by Wandsworth Council against the scheme of the London County Council for a trolley omnibus line, and that their application to be heard against the Bill cannot be entertained.

LONDON GENERAL OMNIBUS COMPANY IN 1921.

LORD ASHFIELD'S REVIEW OF PROGRESS.

Presiding at the annual meeting of the London General Omnibus Company, Limited, held on February 23, Lord Ashfield, in the course of his remarks, said—Considerable progress has been made in the replacement of the pre-war type of omnibus by larger omnibuses of modern and improved design. By the close of the year, 926 "K" type omnibuses, each seating 46 passengers, and 205 "S" type, each seating 54 passengers, were brought into service by your company alone, and similar steps to reinstatement had been taken by the allied companies. The seating capacity of the active fleet at January 1, 1921, was 95,000, and at December 31, 1921, 114,000, an increase of 20 per cent. The experience obtained of the working of the "S" type has been good, and your company has felt justified in proceeding with orders for further substantial numbers, which it is expected will be added to the fleet during the first half of the current year. During the year the Central Overhaul Works at Chiswick have been opened. This has enabled the standard of maintenance to be made uniform throughout the whole fleet, and has added to its efficiency. It has also enabled the time taken for the overhaul of a vehicle to be reduced from 16 to four days, with the result that the fleet of omnibuses available for service upon the streets is greater by 3½ per cent. With the purchase of the additional omnibuses it will be necessary to provide further garage accommodation. The development of the services in the north-eastern and eastern quarters of London will particularly require additional garage accommodation.

TRAFFIC RESULTS FOR 1921.

The company works and maintains the omnibuses of the Gearless Omnibus Company and the Tramways (M.E.T.) Omnibus Company, which shared on a percentage basis. Your company has taken steps to acquire, as from January 1, 1922, the shares and undertakings of these companies so that there may be a further consolidation of interests. To summarise the principal feature of the year 1921, it has been a resumption of progress interrupted by the war, and the development of motor omnibus services to provide satisfactorily and fully for the whole of the Greater London area. The number of passengers carried by your company during the year has been 761,250,000, or 6,700,000 less than in the previous year. The decline is of recent occurrence, as owing to the abnormally fine weather of the summer of 1921 the traffics carried during those months exceeded our ordinary expectations. From the opening of April to the close of October there were only six week-ends when the weather was in any way unfavourable to pleasure riding. If the motor omnibus companies of London as a whole are considered, the total number of passengers carried during the year was 931,750,000, or approximately one-third of the whole local traffic movement in the Metropolitan area. This compares with 936,000,000 carried in the year 1920. The decline is slight, though I regret to say it is continuing. There seems to a general lack of money, which restricts the number of rides taken by the population, and until there is a restoration of prosperity among the inhabitants I am afraid we cannot look forward to an expanding traffic. It is necessary, therefore, for us to pursue a conservative policy.

FINANCIAL DETAILS.

Your company received as its share of the Common Fund £260,568, as against £113,437 in 1920, an increase of £147,131. The traffic receipts after the operation of the Common Fund amounted to, in round figures £7,501,000, as compared with £6,934,000 in the previous year, an increase of £567,000. Miscellaneous receipts amounted to £157,000, as against £132,000 in the previous year, an increase of £25,000, which may be attributed chiefly to advertising upon the motor omnibuses. The total receipts of your company, therefore, amounted to £7,684,000. The working expenses amounted to £6,936,000, leaving a net amount of £748,000 or £241,000 more than a year ago. After all the expenses and charges for the year have been met, the balance available for dividend on the ordinary shares is £319,411, an increase of £146,248 over that available in 1920. An interim dividend of 4½ per cent., free of income tax, was paid on the ordinary shares of the company in August last. This required £141,459, and leaves £177,952 still available. Your directors therefore recommend the payment of a final dividend of 3½ per cent free of income tax, making for the year 8 per cent. free of tax. The accounts show that the expenses for the year 1921 are somewhat more than in 1920. The increase is 4 per cent. The mileage worked

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MOTOR TRAFFIC

has increased from about 86 millions to 87 millions of miles, or by just over 1 per cent.

The revised fares which were brought into effect on September 26, 1920, continued in force until December 1, 1921. These revised fares met, as was expected, the financial requirements of the companies, and served to put transport upon a reasonably remunerative basis. On December 1, 1921, the London County Council decided to revert to the fares which had been in force upon its tramways prior to this revision, and in order to protect their own traffic the omnibus companies were compelled to adopt similar fares in the London County Council's area. Since this alteration in fares it is admitted that the London County Council have not gained. I see one estimate is given that the loss is £10,000 a week. Lord Ashfield also referred to the fact that in the session of 1920 the London County Council promoted a Bill for the acquisition of motor omnibus powers in London, and in particular they desired to have the power to run omnibuses upon short routes in the central area connecting the tramway systems north and south of the river. An undertaking was given before the House of Lords Committee on the hearing of the Bill that an attempt would be made by your company to co-operate with the London County Council in providing the motor omnibus services required, and in pursuance of this undertaking your officers met the officers of the London County Council and have carried out during the last year various experiments in the way of short services and through bookings to see just what the requirements of the traffic were. I can only repeat now the undertaking that was given before the House of Lords Committee, that if there is any traffic in London which requires motor omnibus facilities, then your company is able and willing to give those facilities, but I think you will agree that we should not be asked to give facilities which it is clear are not required. The loss to your company has amounted to £22,000 in the course of the year. The London County Council are promoting in this present session of Parliament a Bill for the construction of a short length of tramways through Amhurst Park near Finsbury Park, and a considerable cross-country route to be worked by railless traction in South-east London. Your company has lodged a petition to be heard before Parliament upon these proposals.

The report and accounts were adopted.

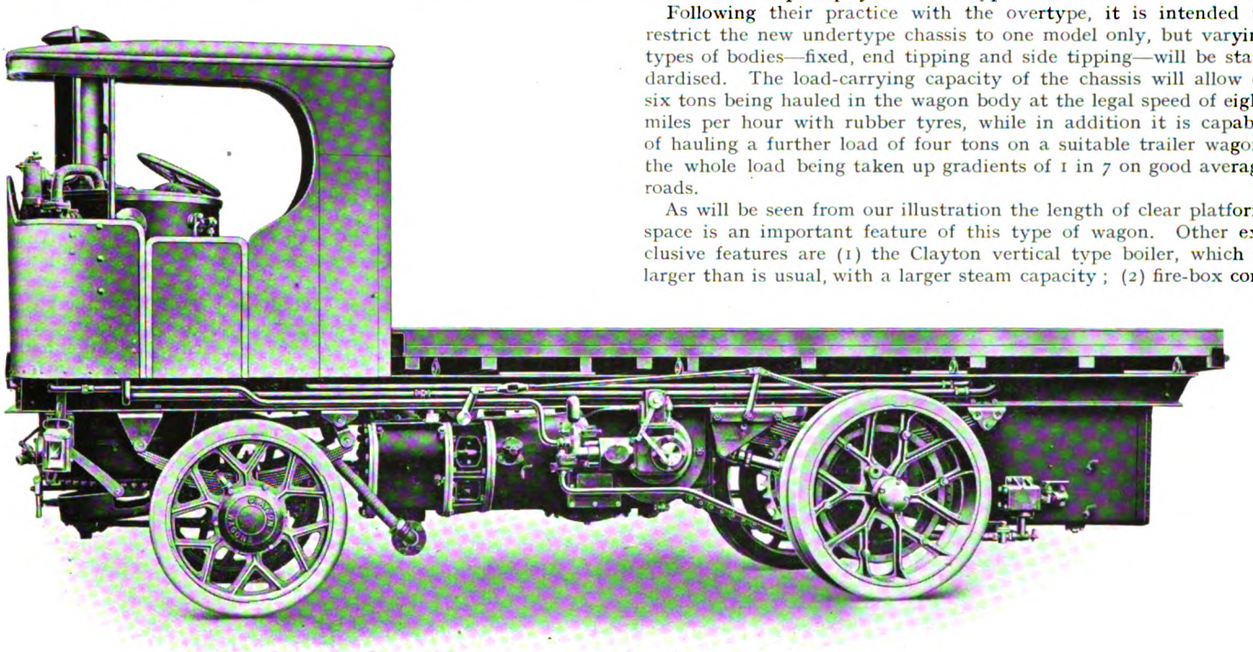
At a meeting of Edinburgh Town Council, Councillor C. J. Mancor, chairman of the Tramways Committee, moved approval of the committee's recommendation for the purchase of an additional motor car to be added to the municipal garage.

THE CLAYTON "UNDERTYPE" STEAM WAGON.

For many years the Clayton overtype steam wagon has enjoyed a reputation for efficiency and reliability that has fully justified the makers' decision to specialise in this particular type of machine. With the widening field of road transport, however, and the difficulties facing the use of petrol vehicles for heavy loads, Messrs. Clayton Wagons, Limited, came to the conclusion some time ago that the scope of the steamer would be materially extended, and in order to meet fully the anticipated demand, decided to depart from their previous practice and design an undertype machine. Owing to the exigencies of supply and demand, it was found impossible to plan the manufacture of the new type until the completion of the works extensions gave the necessary facilities. With these extensions the company's works at Lincoln now form the largest British factory exclusively devoted to the manufacture of steam wagons, and it is anticipated that they will now be in a position to fulfil orders promptly for either type of vehicle.

Following their practice with the overtype, it is intended to restrict the new undertype chassis to one model only, but varying types of bodies—fixed, end tipping and side tipping—will be standardised. The load-carrying capacity of the chassis will allow of six tons being hauled in the wagon body at the legal speed of eight miles per hour with rubber tyres, while in addition it is capable of hauling a further load of four tons on a suitable trailer wagon, the whole load being taken up gradients of 1 in 7 on good average roads.

As will be seen from our illustration the length of clear platform space is an important feature of this type of wagon. Other exclusive features are (1) the Clayton vertical type boiler, which is larger than is usual, with a larger steam capacity; (2) fire-box constructed to allow expansion without straining, the arrangement of the water tubes cross tubes; (3) engine having distance pieces between the cylinder and crank case, with the result that in the event of the glands leaking, that action does not deteriorate the oil, but is plainly visible, while the glands are easily accessible for adjustment; (4) reversing and cut-off control. Both cylinders are fitted with balanced piston valves, and this reversing action and increased power by cut-off are controlled through this medium by a lever near the driver's seat.



"Undertype" Steam Wagon which Messrs. Clayton have added to their "Overtype" Productions.

The following is a brief specification, together with principal dimensions—The boiler is the Clayton patent vertical type, constructed of Simens-Martin mild steel plates to withstand pressure up to 230 lb. per square inch. The engine is of the enclosed type, with cylinders 6¾ in. by 10 in., both this and the crank case being totally enclosed and arranged for automatic lubrication. The crank shaft is perfectly balanced, and runs on heavy gun-metal bearings. The main drive is a simple direct drive between the crank shaft and rear axle by means of a roller chain. The steering is of the Ackerman type of improved design, centred above the tyre, with extra large bearing, giving great wearing surface. The differential is enclosed in a cast-iron casing which forms a perfectly dust-proof oil bath. The wagon is mounted on long laminated springs to both front and rear axles, the wheels being cast-steel "Y" pattern, suitable for fitting either steel or rubber tyres. An internal expanding brake, "Ferodo" lined, acts upon both wheels

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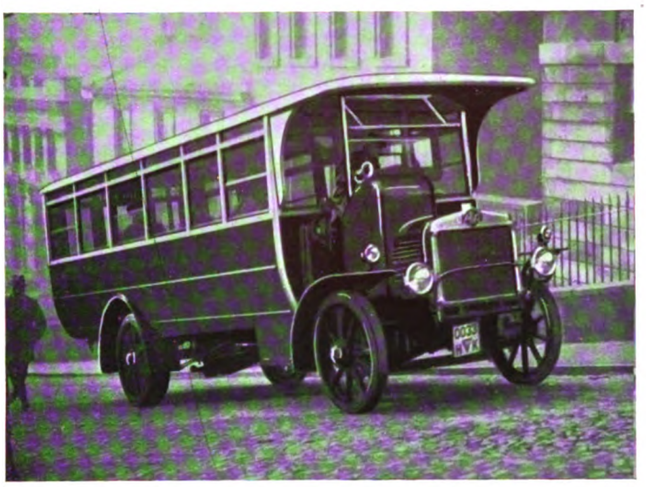
through the medium of rings bolted thereto. The total length of the wagon is 20 ft., the width over splashers being 6 ft. 8 in., and the wheel base 10 ft. The length of the standard platform, inside measurement, is 14 ft., and the width 6 ft. 6 in. The rear wheels are 3 ft. 6 in. by 10 in. wide, and the front wheels 2 ft. 10½ in. by 6 in. in width. The capacity of the water tank is 150 gallons, and that of the fuel bunker 4 to 5 cwt.

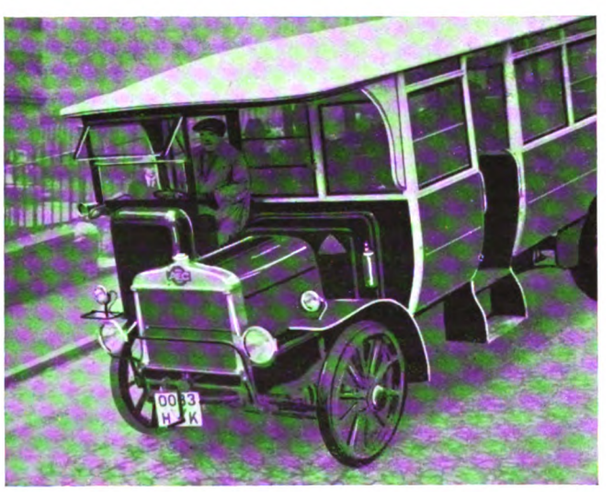
A.E.C. PROVINCIAL OMNIBUS.

An interesting demonstration of the hill-climbing capability of the new model 4 single-deck omnibus designed by the Associated Equipment Company for provincial operation was given during



38-Seat Provincial Type of A.E.C. Omnibus Engaged in Hill Tests at Glasgow.

the recent motor exhibition at Glasgow. In the subjoined photographs the vehicle is shown ascending and descending Scott Street hill, off Sauchiehall Street, which has a gradient of 1 in 3·8. The climb was performed from a standing start at the foot of the hill, the road being covered with a thin layer of snow at the time. The omnibus seats 38 passengers, and on this occasion 18 persons were



The Same Omnibus Descending Gradient.

conveyed, the vehicle mounting the hill with ease. It was then turned and driven down the incline, keeping a perfectly even track in spite of the bad surface. During the week of the show this test was repeated several times.

OMNIBUSES AND ROAD CHARGES.

QUESTION TO BE DISCUSSED WITH TRANSPORT MINISTRY.

At a meeting of the Association of Municipal Corporations the Law Committee, reporting on "Omnibuses—Road Adaptation Charges," stated that in a number of local Acts passed in recent years authorising Corporations to run omnibuses beyond the limits of their boroughs, provisions had been inserted, generally at the instance of County Councils, requiring contributions to be made—

(1) Towards the cost of maintaining roads over which the omnibuses are run; and
(2) Towards the cost of reconstructing and adapting those roads for the purpose.

In the Acts passed during the last session of Parliament, however, the obligation to contribute anything towards the cost of maintenance was omitted, and the obligation to contribute towards the cost of reconstruction or adaptation such an amount, if any, as might be agreed or determined by the Minister of Transport, was retained. By virtue of the Finance Act 1920, and of the Roads Act 1920, large sums have now to be paid annually into the Road Fund in respect of licences for mechanically propelled vehicles, that fund being applicable towards the construction of new roads and the maintenance and improvement of existing roads. In consequence, no doubt, of this provision, a section of the 1920 Roads Act enacts that "where any persons are, whether by virtue of any Act or otherwise, liable to pay any sums by way of mileage charges or other annual payments in respect of the use of any road by their vehicles, the Minister may, on an application by those persons in that behalf, and after considering any objections made by any person interested, suspend, modify, or determine the liability to make the payment, as he shall think fit." In view of these circumstances (the Law Committee continued) a further consideration of the matter is clearly desirable, and the Minister of Transport has been good enough to write the County Councils Association and the Association of Municipal Corporations to attend a meeting for the purpose of discussing the question.

The report was adopted, and representatives appointed to discuss the subject with the Minister of Transport.

The Crosville Motor Company, Chester, recently applied to the Ministry of Transport under the provisions of Section 10 of the Roads Act 1920, for the determination of their liability to pay mileage charges to the highway authorities concerned in respect of the use of certain roads by the company's omnibuses. The Ministry have decided that the liability shall be determined as regards the use of six roads in Chester.

ANNUAL LONDON MOTOR PARADE.

The sixteenth annual parade of commercial motor vehicles, organised by the Commercial Motor Users' Association with the object of encouraging drivers to take a personal interest in the driving and the condition of their vehicles, and to run them without accident, will take place in London on Saturday, March 25. The handsome silver challenge cup, first offered in 1910, will again be awarded to the owner whose "team," in the opinion of the judges' committee, is in the best condition, having regard to the class of work upon which the units are employed, the ages of the machines, and the total distance run by them. The driver of each vehicle in the winning team will be given a cash award and a silver medal. The drivers of each vehicle in the "runners up," and third, fourth, fifth, sixth and seventh teams will also receive a cash award, and drivers of each vehicle in the eighth, ninth, tenth, eleventh, and twelfth teams will be "highly commended."

PRODUCER FUEL.

Mr. Drummond Paton recently exhibited before the Mining Students' Association at Wigan Mining College a new form of smokeless fuel. From it the hydrogen compounds have been extracted, and it retains the maximum heat value of the original coal. Mr. Paton states that in London experiments are being made with this new fuel, a 3½-ton Leyland lorry using it having gone 100 miles with a 3½-ton load at a cost of 5s., compared with £3 which would be the cost of petrol for the same load and distance. The new fuel is gasified in a small producer on the lorry, the lorry thus producing and burning its own gas.

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HICKMAN LIGHT WEIGHT OMNIBUS.

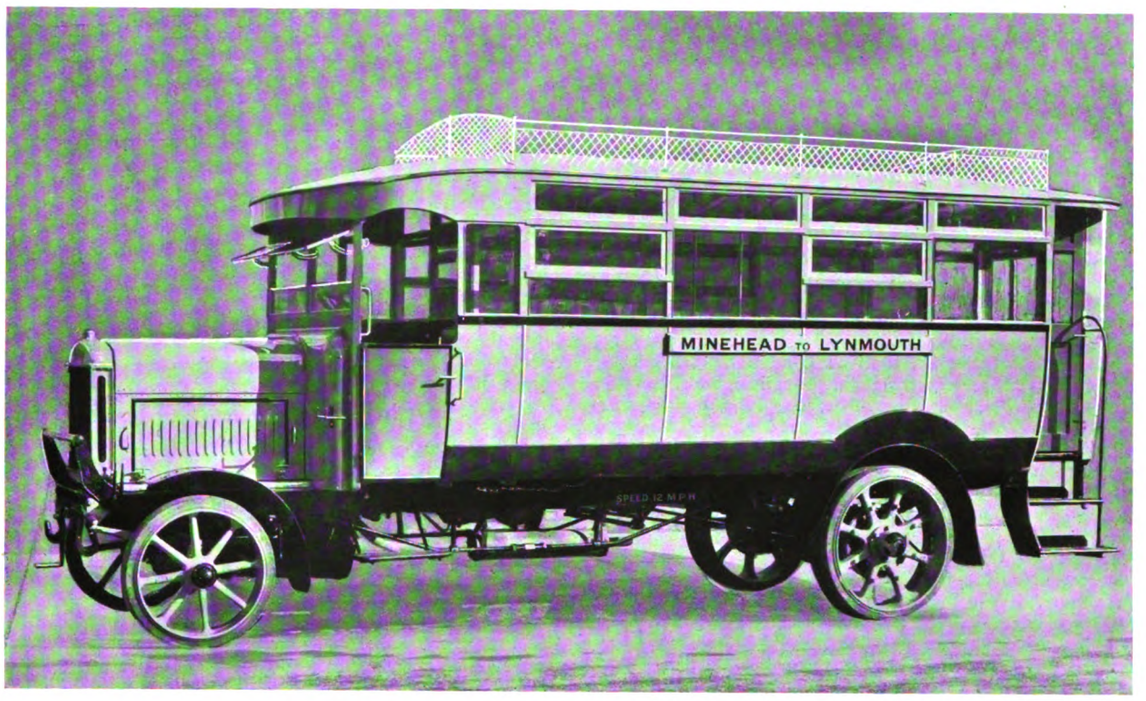
Our illustration shows one of the 36-seat single-deck omnibuses now being delivered by the Hickman Body Building Company, of Grove Road, Balham, for service in the West of England. In view of the exceptionally heavy gradients on the routes over which it is intended to maintain a regular service with these vehicles, it was essential that the dead weight should be kept down as low as possible consistent with the necessary strength to withstand the heavy duty of the service. The special form of construction under the "Hickman" patents whereby all joints are reinforced with light steel castings, enables much lighter timber scantlings to be used, while the joints between the cross members of the bottom frame and bottom sides are eliminated, thus rendering the usual heavy forgings superfluous.

The bottom member of the sides is placed on edge, and lapped to the pillars; it thus forms a continuous side member, which adds considerably to the longitudinal strength of the body. The important result of this form of construction is a substantial reduction in weight and a considerable increase in strength when compared with the usual type body, which frequently fails through the shrinkage of timber at the joints, thus permitting lateral and even longitudinal movement. The design of the body, as will be seen by the illustration, is most pleasing, and is specially suited for a country service. Ample protection is given for the driver and the passengers in front by means of the deep canopy bend and the plate-glass screen.

The bodies are panelled with steel, butt jointed on all pillars the joints being covered with aluminium moulding, so that any damaged panel can easily be removed and replaced. The interiors are lined with birch ply butted between all pillars, thus adding greatly to the strength of the body and increasing the available length and width to the maximum.

The seating arrangement provides for 28 seats facing forward, five with back to the driver, and three on the driver's seat. Each of these are fitted with spring cushions, upholstered in dark brown "Rexine" leather cloth. Ample ventilation is provided by means of eleven extra deep ventilating windows, five on each side and one in the front end, supplemented by four half windows.

The rear platform is supported by a specially designed light steel casting, and enclosed by a rounded panel well within the radius of the corner pillar, so as to insure freedom from contact with road obstructions or other vehicles. The recessed rear entrance is fitted with a half-glazed door, which when open lays flat with the end of the body, clear of all obstruction. A mahogany partition divides the body into smoking and non-smoking departments.



Hickman 36-Seat Omnibus Mounted on Leyland Chassis.

L.G.O.C. "SAFETY" RECORD.

The London General Omnibus Company, having analysed their returns of working for 1921, announce a remarkable improvement upon previous records of all round efficiency.

The year has shown a decrease of 10 per cent. in the gross total of accidents, and there has been a decrease of a fraction less than 60 per cent. in the number of fatal accidents. A period of 67 days, from September 27 to December 6, elapsed without any fatal accident being recorded. The significance of the improved safety record lies in the fact that it goes with a vastly increased mileage run by the omnibuses. In 1921 the company's omnibuses ran 1,200,000 miles more than in the previous year.

Taking mileage as the measure of "third party" accidents, the total average of accidents—including the merest casualty—works out at one for every 8,000 miles run. This is a decrease of 12 per cent. as compared with the 1920 record. The company have achieved a marked advance in efficiency in vehicular working. The mileage lost through breakdowns only represented one-third of a mile per 1,000 miles run in 1921. This figure by a long way surpasses all records.

THE COACHING SEASON.

As an indication of the enterprise likely to be shown by motor coach proprietors this season, it may be mentioned that Dennis Brothers, of Guildford, have received an order for 17 vehicles from one company. The London General Omnibus Company intend to develop their half-day and evening coach trips, with tea or supper at country inns.

Among provincial undertakings, the Torquay Tramways Company will continue, on an extended scale, their local and long-distance tours, the latter with hotel accommodation. Mr. H. J. Nisbett, the engineer and manager, regards the large coach as essential if the trips are to be run at low fares and earn a dividend, particularly when more than half of the yearly traffic is done in three months of the year. Mr. Nisbett anticipates that within a very short time the large coach will be fitted with pneumatic tyres.

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RAILWAYS AND ROAD TRANSPORT.

WITHDRAWAL OF APPLICATION FOR POWERS TO CARRY PASSENGERS.

March 2 was the date set down for the second reading in the House of Commons of the Bill of the North Western and Midland Group of Railways for powers to provide road transport services. Sixty-five public bodies, including municipal corporations, County Councils, Chambers of Commerce, motor organisations, and haulage companies had lodged petitions against the Bill.

Early in February the promoters addressed the following communication to the petitioners—

> "The promoters of this Bill have decided not to proceed with the proposals to carry passengers, and in the hope that it may satisfy many of your clients who contemplate petitioning against the Bill, we hereby undertake, subject to the sanction of Parliament, to strike out of Clause 4 the words 'and passengers and their luggage.' Clause 12 will, of course, not be proceeded with, except possibly so far as it relates to the carriage of merchandise. The preamble and Clause 10 will also be amended, so as to conform with the limited scope of the Bill."

SIX MILLION TONS DIVERTED TO THE ROADS LAST YEAR.

On February 15 the railway companies issued a statement giving their case for seeking to convey goods traffic by road. In it they stated that the enormously increased use of the roads by mechanically propelled vehicles had opened up a new vista of transportation, and they contend that it is reasonable, not only in their own interests, but in the interests of the public generally, that they should be allowed to keep abreast of the times and to render the best service possible to the trading community.

The companies estimate that 6,000,000 tons of traffic, mainly consisting of the more valuable classes, were diverted from the railways to the roads last year. A considerable proportion of the traffic so diverted passes between places within a radius of 50 miles, but the competition by road motor vehicles is being very largely extended for longer distances, such as London and Birmingham (111 miles), Liverpool and Birmingham (88 miles), and Manchester and Birmingham (84 miles). Short-distance traffic, they urge, can be conveyed more cheaply and expeditiously by road throughout than by carting it to railway depots, loading up, conveying it by railway, and unloading and carting from the destination station to the premises of the consignee. In such cases wagon mileage is saved to the companies, and more trucks are available for longer distance traffic. The companies are able to economise engine power and better facilities can be given to the traders by relieving congestion at stations and depots.

The promoters, if road powers are granted them, do not propose to invade the territory served by any other railway company, or group of railway companies. As trade revives and traffic increases, portons of the railway systems will be seriously congested, and it is the view of the railway companies that, if they are granted road motor powers, the threatened congestion will be relieved without the necessity for incurring large capital expenditure, which in the present state of finance presents grave difficulties. Although the railway companies in respect of road charges will always be subject to the control of the Rates Tribunal, there is nothing to prevent the independent road carrier underquoting the railway companies if their resources enable them to do so.

MEETING WITH THE MOTOR LEGISLATION COMMITTEE.

Representatives of the railway companies attended a meeting of the Motor Legislation Committee under the presidency of Sir W. Joynson-Hicks. They explained the objects of the Bill, and emphasised the withdrawal of the clauses relating to passenger transport by road. Meetings of railway employees have passed resolutions in favour of the measure, and Mr. J. H. Thomas, M.P., of the National Union of Railwaymen, and one of the sponsors of the Bill, has stated the reasons why he supported the proposal. His statement evoked a reply from Mr. J. F. Shaw, managing director of the Road Transport Clearing Houses, Limited, who observed that in view of the fact that 90 per cent. of available traffic is not suitable for road transport, it is very doubtful if ten per cent. can be diverted to the roads. He also pointed out the dangers to the community of the workers in all forms of transport being in the hands of members of one amalgamated union, which, he understood, was probable with the existing Transport Workers' Union and the N.U.R.

At a special general meeting of the London and North-Western Railway Company at Euston, on February 28, approval was given to the Bill.

The Chairman (Mr. C. Napier Lawrence) said it must obviously be reasonable that all railway companies should possess powers of road transport. During the State control of railways considerable diversions of traffic from the railways to the roads occurred, and it was estimated that 6,000,000 tons of traffic, mainly consisting of the more valuable classes, were so diverted in 1921. This was part of the very traffic which the railways were built to accommodate, and the companies had abundant justification for seeking the necessary powers to retain or recover the traffic that had been diverted from them. It was a fallacious view on the part of opponents of these proposals that these powers should not be granted because railway companies ought to be restricted to what was called their proper business of transport by rail. To show how ready and willing the railway companies were to meet all legitimate criticism, the chairman said that, in deference to a considerable body of opinion, an undertaking had been given to abandon the powers to carry passenger traffic by road.

FURTHER CONCESSIONS BY RAILWAY COMPANIES.

The North-Western and Midland Railway group, in a statement made on March 13, notified further concessions to meet opponents' objections. They stated that the main objection appears to be that although the railway companies will be required to submit a schedule of standard charges to be approved by the Railway Rates Tribunal, they will still be free to quote exceptional rates below the standard charges, and that such latitude will enable them to compete with other existing road carriers to extinguish ultimately such competition and thereafter increase the rates. The railway companies have no desire to compete unfairly with existing road carriers. All they desire is an equal right with any other industrial organisation to develop such modern methods as are in the interest of their customers and themselves, and the only latitude they desire in the matter of charges is that already conceded in respect of railway rates. All exceptional rates must be reported to the Minister of Transport, and he may refer to the Rates Tribunal if, in his opinion, they are likely to prejudice the interests of any class of users not benefited by the rates in question or to jeopardise the standard revenue which the railway companies are required to earn. As an additional safeguard the railway companies are prepared to insert in the Bill a clause whereby road transport interests will have the same right as is granted to shipping and canal interests to appeal to the Minister of Transport and thereafter to the Rates Tribunal if it can be shown that the railway companies are charging exceptional rates which are detrimental to the public interest or inadequate having regard to the services in respect of which such rates are charged.

To safeguard themselves from being required to maintain services which are not profitable, the railway companies are prepared to insert further a clause in the Bill to the effect that the rates charged for road transport services shall be such as will produce a net revenue sufficient adequately to remunerate the capital employed in operating the road services. Further, to define their responsibilities in connection with the establishment of road services, the companies are willing to insert a clause providing that the Railway Commissioners shall have power to require the continuance of a road transport service instituted by the railway companies unless it can be proved that such service is unprofitable or is not required in the public interest.

In a recent interview, Mr. Arthur Watson, general manager of the London and North Western Railway, said that between 1913 and to-day the turnover from rail to road had been so gradual that what was virtually a revolution in transport had been achieved without the public being aware that anything particular had happened. In 1913 there were 16,700 heavy vehicles on the road, while last year there were 120,000 licensed goods motors. Each goods motor might be assumed to run 30,000 ton-miles a year, and an annual licence fee of £30 on each vehicle worked out at less than a farthing a ton-mile, while each of them might damage a road to the tune of 6s. a mile. The ratepayer footed the bill, and railway companies were very substantial contributors to local rates. Last year the principal railway companies paid in local rates £9,608,483: that is to say, while they themselves are denied road rights, they are compelled to subsidise rivals by whom last year alone six million tons of goods were diverted from the railways. They were hopeful that Parliament would adjust matters by granting road rights to the North Western and Midland group.

Tramways, we might add, have long suffered from similar injustice. They maintain a large portion of road surface in which their tracks are laid for the benefit of all comers, including railways and omnibus companies.

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MOTOR VEHICLES FOR MUNICIPALITIES.

GLASGOW TRAMWAYS COMMITTEE have purchased a 3-ton Albion lorry.

LEEDS CLEANSING COMMITTEE have ordered a Lacre motor road sweeper at £650.

BRADFORD BOARD OF GUARDIANS have been recommended to purchase a Calcott coupé car at a cost of £595.

MIDDLESBROUGH CORPORATION are purchasing two motor vans to replace horsed vans used for refuse collection.

JOHANNESBURG COUNCIL have accepted the tender of Colonial Motors, Limited, for one Guy motor chassis for £600.

SALFORD CORPORATION propose to borrow £4,180 to cover the cost of the erection of a motor garage and repair shop.

HACKNEY BOROUGH COUNCIL have received sanction to raise a loan of £7,750 in respect of five 6-ton motor vehicles.

KENDAL HEALTH COMMITTEE have appointed a sub-committee to consider the advisability of purchasing a motor ambulance.

CAMBRIDGE HIGHWAYS COMMITTEE have decided in next year's estimates to provide for the purchase of two or three electric vehicles.

STAFFORDSHIRE STANDING JOINT COMMITTEE have decided to provide 18 motor vehicles for the use of the police. The estimated cost is £5,400.

HESTON AND ISLEWORTH URBAN COUNCIL are recommended by the Health Committee to purchase an 8-H.P. Rover motor car for £220, for the medical officer.

BRIGHTON TOWN COUNCIL have granted the Chief Constable £100 a year towards the upkeep and maintenance of a car to be provided by him for use in supervising the police.

LEEDS FIRE BRIGADE COMMITTEE have purchased a motor lorry for £900 from Leyland Motors, Limited. The Watch Committee have authorised the purchase of a motor ambulance.

CALCUTTA MUNICIPAL COUNCIL have decided to purchase two end tipping bodies, one being for a Thornycroft lorry. The tender of Messrs. McKenzie and Company has been accepted for the supply of a Leyland gully cleansing machine fitted with appliances for road watering.

BURNLEY CLEANSING COMMITTEE have received a report on the saving effected through the use of Karrier motor sweeper during the past six months. The superintendent also reported receipt of a letter from Karrier Motors, Limited, intimating that they expected shortly to make their street sweepers more efficient, and that in accordance with their agreement with the Corporation they were prepared to fit the machine with the new gear.

ISLINGTON BOROUGH COUNCIL have reduced the rates by 1s. 4d. in the £. This has been made possible by, amongst other economies, the saving of 4s. a ton in the cost of refuse collection and street cleansing effected by the use of electrically operated vehicles in place of horse traction. The actual saving on these services amounts to £14,000 per annum. The fleet of vehicles now in use are Edison battery machines supplied by Electricars, Limited, an illustrated description of which appeared in our issue of January 19.

OMNIBUS SERVICES.

BIRKENHEAD.—The Corporation propose to acquire land at a cost of £400 for the purpose of a motor omnibus station at Marston.

BIRMINGHAM.—The Tramways Committee, with a view to improving the omnibus services, have agreed to give a trial on the Harborne route to the A.E.C. "K" type as used in London. This type seats 54 passengers, as compared with 34 accommodated in the present vehicle. On March 6 the 4d. fare on the omnibuses was reduced by a halfpenny, and the higher fares by one penny. The 2d. fare has not been altered, as the Harborne and Moseley routes cross the tramways at Five Ways, and passengers for Five Ways might make greater use of the omnibuses to the inconvenience of the Harborne and Moseley omnibus passengers.

BLACKBURN-CLITHEROE.—The London and North-Western Railway Company propose to erect four halts on the line between Blackburn and Clitheroe, and to run trains of two steam cars in order to compete with the omnibus traffic. The district is regarded as the pleasure ground of Blackburn and East Lancashire towns.

BLACKPOOL.—As the Corporation have rejected the proposal for municipal omnibus services, the Tramways Committee have suggested that licences should be granted to those who will agree to terminate services at the end of three years without compensation.

BRIGHTON.—The Council have granted licences for ten additional omnibuses, but the vehicles are not to be used in competition with the Corporation's tramways.

BURNLEY.—The Tramways Committee have asked a sub-committee to report as to the desirability of instituting omnibus services in connection with the tramways.

ESSEX.—The Commissioner of Police has drawn the attention of Walthamstow Urban Council to the danger to omnibus traffic owing to trees in some roads projecting beyond the edges of the kerbs. The Council have directed the surveyor to remedy the cause of complaint.

HULL.—The Ministry of Transport have sanctioned a loan by the Corporation of £10,000 for the purchase of six omnibuses to be operated by the tramways department. The repayment period is fixed at six years. The six months' working of the Stoneferry omnibus service shows a loss of £413. The operating cost averaged about 16d. per omnibus mile.

KENT.—Sevenoaks Urban Council have asked the L.G.O.C. and other companies to request their drivers to go slowly through the town, as complaints have been received of vibration.

LEEDS.—The Tramways Committee have decided to purchase two small motor omnibuses to be used in linking up Farnley with the Tong Road and Kirkstall tramway routes.

LONDON.—The County Council have, at the request of Islington and St. Pancras Councils, made application to the Minister of Transport under Section 7 (4) of the Roads Act 1920, with a view to the issue, after holding an inquiry, of an order prohibiting omnibus traffic along the route proposed by the L.G.O.C. from King's Cross to Highgate via York Road, Brecknock Road, Junction Road, and Highgate Hill, on the ground of the unsuitability of a part of the route for such traffic. The L.G.O.C. recently inaugurated a service over the route from West Norwood to Catford upon which the London County Council propose to operate railless trolley vehicles. Included in the route are two steep hills, one being among the most severe gradients in London. The company intend to oppose the County Council's Bill. Lewisham Borough Council have reported that the new omnibus route is objectionable, inasmuch as the service will be over roads in their district which are unsuitable. The Council are also opposing the County Council's scheme.

MIDDLESEX.—Willesden Urban Council have informed the L.G.O.C. that the company will be held liable for any extra expense incurred in the maintenance of highways used by a new service from Willesden to Neasden, as the Council consider the roads to be unsuitable for omnibus traffic. In a reply to the Council's letter, the company state that the license duties on their vehicles have been substantially increased for the purpose of highway construction and reconstruction, and they decline to accept any further responsibility in the matter, but suggest that the Council should make representations to the Ministry of Transport with a view to that authority making a contribution towards the cost of maintenance.

PRESTON.—The Ministry of Transport have sanctioned the raising of a loan by Preston Corporation of £4,765 for the purchase of motor omnibuses, to be repaid in six years.

SCOTLAND.—The Scottish Commercial Motor Users' Association have lodged petitions in opposition to the following Provisional Order applications—Railways (West Scottish) group; Aberdeen Corporation, Glasgow Corporation, and Ayr Burgh. Each application is for powers to run motor omnibuses, the three local authorities asking to run beyond their boundaries. The Association in each case urges that there is no public demand for omnibuses along the routes proposed which is not met or capable of being met by local traders, and that is it improper to institute municipal services in competition with existing and prospective services provided by private enterprise.

SURREY.—The London General Omnibus Company have opened a new garage at Kingston-on-Thames. This town has become a terminus for country omnibus routes, and the new garage is devoted exclusively to rural traffic requirements. The services link the numerous villages in the Thames valley with Kingston, a market town, by means of regular communication with Woking, Shepperton, and Chertsey. These more convenient services attract a considerable traffic from the railways.

TAUNTON.—By twelve votes to seven the Corporation have decided not to purchase the undertaking of the Taunton Electric Traction Company, which has a route length of about two miles. The company ceased operation in May last. The Corporation intend to endeavour to provide a service of omnibuses by private enterprise, and to secure the removal of the tramway track.

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MOTOR TRAFFIC NOTES.

FISH TRAFFIC BY ROAD.—Since the first week in March fish has been despatched by road motor vehicles from Aberdeen to Glasgow. The cost per ton by road is about 28s., against 74s. by passenger train and 56s. by goods train.

ROAD RESTORATION IN IRELAND.—The Irish Provisional Government are making a grant of £300,000 for road restoration. During the last few years military lorry traffic had cut up the roads, and the I.R.A. had "trenched" them and destroyed bridges.

COMPULSORY MUDGUARDS.—Smethwick Watch Committee recommend that, in view of the fact that there are now several types of efficient mud splash guards available, the Government should be asked to introduce legislation making the attachment of such guards to heavy motor vehicles compulsory.

DIRECTION SIGNS TO RELIEVE CONGESTION.—Manchester Corporation have asked the city engineer and chief constable, after conference with the Ministry of Transport, to prepare a scheme for the erection of road direction signs with a view to relieving the density of traffic in the centre of the city.

LACK OF CAR ACCOMMODATION IN BRISTOL.—By a large majority the Bristol Corporation have rejected a motion that the Watch Committee be asked to select a few sites in the centre of the city and in the suburbs where motor cars might be left unattended; also to consider the question of providing a covered motor park where cars could be left.

OLYMPIA TO BE ENLARGED.—Following representations made by the Society of Motor Manufacturers and Traders, the directors of Olympia, to meet the requirements of the motor and other large trade exhibitions, have made arrangements to build a new hall on similar lines, connecting up with the present building, and having an entrance in Hammersmith main road.

LONDON MOTOR FIRE APPLIANCES.—During 1921 the London Fire Brigade was entirely converted to motor traction. There are 79 motor escape vans, 87 engines, 13 tenders and lorries, 15 cars, 10 hose carts and ladder trucks, 4 fire floats. The abolition of horses has enabled several fire stations to be closed and the staff to be reduced. There are now 1,913 officers and men.

COMPETITION WITH SCOTCH RAILWAYS.—Aberdeen District Committee of the County Council on February 20 authorised an excess expenditure of £2,000 for the upkeep of roads. A member stated that the traffic was "getting something terrible" on the roads, and that the poor returns of the Great North of Scotland Railway showed the major portion of the traffic was on the roads.

SHEFFIELD PRIZE TO OMNIBUS DRIVER.—Mr. A. R. Fearnley, general manager of Sheffield Corporation Tramways and Motors, having reported that omnibus driver A. Dunham has for the last four months of 1921 occupied the premier position in economy of petrol consumption, the Tramways Committee decided to make a grant of two guineas to show their appreciation of the economical way in which he performs his duties.

FORBIDDEN ROADS.—Since the Hampshire County Council made their original proposals for closing narrow roads to coach traffic, the subject has been further investigated, and negotiations have taken place between the authorities and the coach proprietors. The result is that the original applications have been modified to an extent which the County Council hope will avoid any serious objection. The revised schedule includes 40 miles of roads deemed unsuitable for the traffic.

INCREASE OF MOTOR VEHICLES IN BIRMINGHAM.—Up to the end of January licences had been issued for 14,993 vehicles in Birmingham, as compared with 11,982 at the same date in 1921. Included in the present total are 4,459 private cars; 3,469 commercial and industrial vehicles; 590 taxi-cabs, omnibuses and coaches; 612 tramway-cars (a slight decrease); 209 private horsed carriages; 31 horse-drawn hackney carriages; and 5,172 motor cycles. The total revenue received is about £150,000.

OMNIBUS AND TRAMWAY RIVALRY.—There is no abatement in the battle between the Potteries Electric Traction Company and various proprietors of omnibuses and coaches. On several routes the tramway fare has been reduced in order to secure traffic attracted to the competing undertakings. The speed of the cars has also been increased. In the event of the reduced fares causing them to abandon their competition, the owners of the road vehicles intend to attack the company on routes where fares have not been lowered.

POLICE CONTROL OF TRAFFIC.—H.M. Inspector of Constabulary, in his report for 1921, attributes the fluctuations on the authorised strength of police forces to the increasing need, especially in large towns, for the regulation of traffic. The introduction of mechanical transport, he says, "has not only increased the need where it existed, but has created it elsewhere. The demand for control increases, not only in the interest of public safety, but for the purpose of trying to make the roads accommodate a traffic for which they are daily more inadequate."

ROAD TRANSPORT COMPETITION WITH RAILWAYS.—In support of an application made on February 21 to the Rates Advisory Committee of the Ministry of Transport for reduced rates for the chilled meat trade, it was stated that the trade was finding road transport much cheaper and more effective than the railway facilities. The committee decided that a sufficient case had not been made out for altering the present rates. The committee reduced the rates for cheaper grades of meat offals and for cider apples. They decided, however, that the companies' proposals for hay and straw should stand.

SUCCESSFUL RIVALRY WITH A RAILWAY OMNIBUS.—After nearly fifteen years' service, the Great North of Scotland Railway Company on February 28 withdrew their passenger omnibus between Newburgh and Aberdeen. The withdrawal is due to the competition of an omnibus run by two ex-service men, who began operations in August last with a 12-passenger vehicle against the 20-passenger machine of the company. They charged a return fare of 4s.—2s. less than that demanded by the company. At one time the company kept two vehicles employed. The company are continuing their goods service by road.

INDIA'S MOTOR IMPORTS.—Imports into India of motor lorries and trucks show a considerable increase from 1,229, valued at £483,509, in 1919-20, to 2,947, valued at £2,234,318 in 1920-21. In the former year the United Kingdom only supplied 197 lorries, of a value of £158,424, whereas the United States shipped 936 trucks, valued at £269,534. During 1920-21 the number of cars imported was 15,432, as compared with 9,525 in 1919-20. Of the 15,432, 10,120 came from the United States, 2,541 from the United Kingdom, 192 from France, and 2,579 from other countries, the figures for 1919-20 being—United States, 9,353; United Kingdom, 448; France, 3; and other countries, 121.

G.W.R. SUPERINTENDENT OF ROAD TRANSPORT.—Mr. F. C. A. Coventry, who since 1904 has had charge of the road and rail motor services of the Great Western Railway, has been appointed superintendent of road transport. Mr. Coventry began his career as a pupil in the locomotive department at Swindon in 1893, and subsequently served as inspector of materials and assistant to the carriage works manager. He also visited the United States on a tour of inspection. During the war he was attached to the Ministry of Munitions, where he had control over the transport of munitions and the lay-out of various factories all over the country. For his valuable work he was decorated with the Order of the British Empire. In 1919 he was appointed assistant superintendent of the line.

DEVICE TO PREVENT THEFT OF MOTOR VEHICLES.—Mr. J. Blackey, of St. James Street, Paisley, has invented a locking and starting device for the purpose of preventing the theft of cars. Attached to the dashboard, it consists of a contrivance with a number of sockets with plugs to fit, the whole connected with the magneto through the engine. When these plugs are inserted into the sockets in a certain arranged order the car may be started. When the plugs are withdrawn the car remains stationary, and no movement is possible until someone with the requisite code knowledge reinserts them. No mechanic, however skilled, can set the vehicle in motion unless he holds the secret. The same device may be fitted to all classes of motors, but no two will start in the same way unless by pre-arrangement.

HEAVY VEHICLE LICENCES.—In calling attention to road damage by heavy motor vehicles and omnibuses, the Durham county surveyor refers to the "inadequacy of the contribution of these vehicles towards road maintenance under the present licensing regulations." This, he says, particularly applies to the heavy commercial vehicle. Based on the approximate average journeys and carrying capacity of these vehicles, the present taxation may be taken as about 1d. per car-mile for the omnibuses and ¾d. per vehicle mile, or ¼d. per useful load ton-mile for the commercial vehicle. He suggests that the County Council should consider the advisability of making strong representation to the Government that these licence duties are inadequate, and suggesting very material increases, especially as regards the heavy commercial vehicle.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

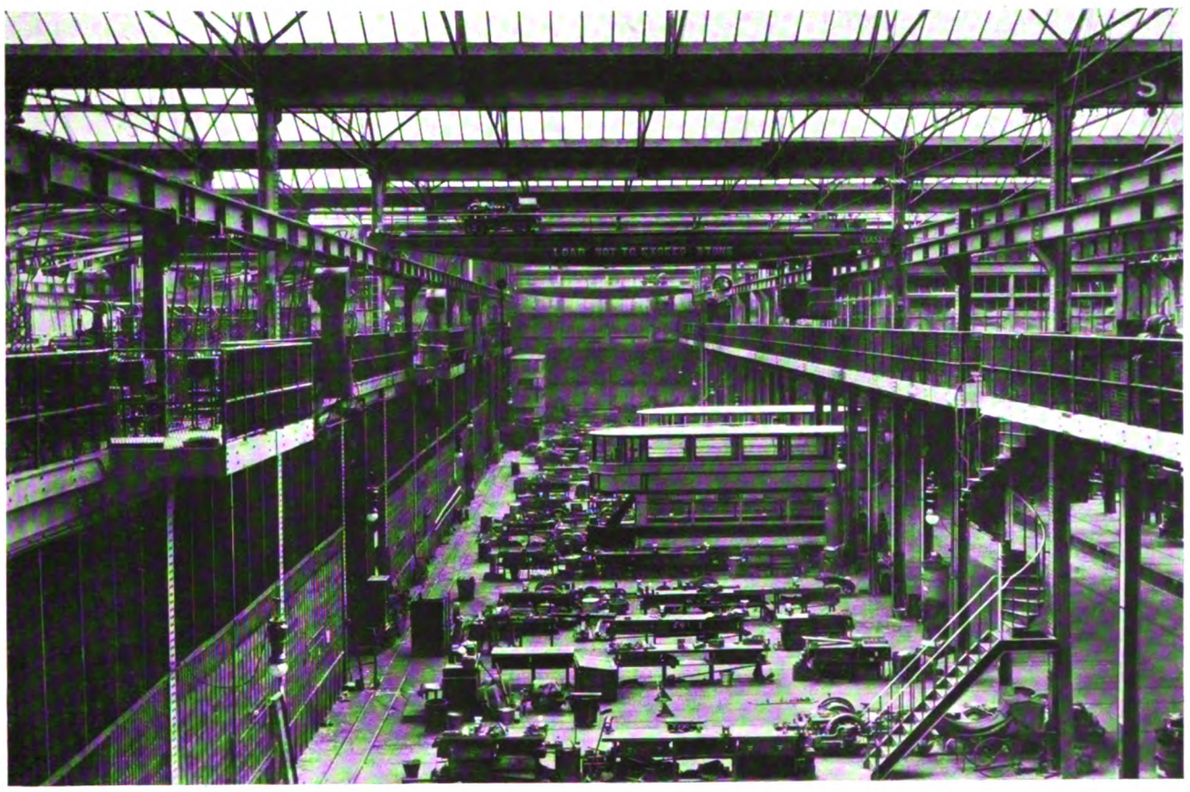
Founded 1892. LONDON, APRIL 13, 1922. VOL. LI.

LONDON COUNTY COUNCIL TRAMWAY IMPROVEMENTS.

EXTENSIONS AT THE CENTRAL REPAIR DEPOT AND GREENWICH POWER STATION.

The policy of centralising the work of repair and renovation of the London County Council's cars dates back to early years of the century. A site of 6·9 acres in extent was then chosen at Charlton, and the first portion of the works was completed in June 1908. The depot has been extended from time to time, and is now in process of completion. Of the whole area, 5·5 acres will be covered by buildings. The main building of the depot will be 650 ft. long and 290 ft. wide. To meet requirements of the police authorities, every car has to be renovated once in each year; this is quite distinct from the minor or running repairs carried out at the running sheds. When the cars are brought in for renovation they are at the same time thoroughly overhauled.

The inspection, paint and body shops are on the right of the inside traverser pit. As the cars enter the depot a general inspection is made, and the amount of work required is determined. Body repairs are carried out and the painting done in their respective shops. On entering the depot, bodies are lifted off the trucks by means of a set of pneumatic jacks, the trucks being run on the traverser to a short track in the truck shop, where they are taken to pieces and every part examined, repaired if necessary, and wearing parts renewed if required. The motors are lifted by electric cranes in their complete state to a gallery situated above the traverser way, where the electric repairs are carried out. Each of the shops is equipped with electric overhead travelling cranes, capable of lifting a complete truck with motors. When the overhaul is completed, every part is re-assembled, and the car tested and returned to its particular car shed to be put in commission again.



The L.C.C. Tramways Central Repair Depot, Charlton—Latest Extension of the Truck Shop.

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At the left of the depot is the portion reserved for machining operations. The wheel shop is equipped with modern high-speed lathes, capable of turning the profiles of two wheels at once. A tyre furnace for shrinking the tyres on the wheel centres, together with special boring mills, completes this shop. The stores are situated below the light machine shop gallery, on the left of the truck shop.

The machine shop deals with all the axle turning, the machining of all the bearings, the manufacture of the brake shoes for the electric track brakes, and all the multitudinous machining work required for the upkeep of the rolling stock of the system. On a small gallery above, light machining and the manufacture of electric fittings is carried out.

On the left of the depot also is the smiths' shop, where the smithing work for the trucks and body ironwork is carried out. All the fumes from the hearth are carried underground by ducts, and are exhausted through large, powerful fans to the outside atmosphere. Adjacent is the temporary foundry, where light cast-iron and brass castings are made. The permanent foundry is now being built.

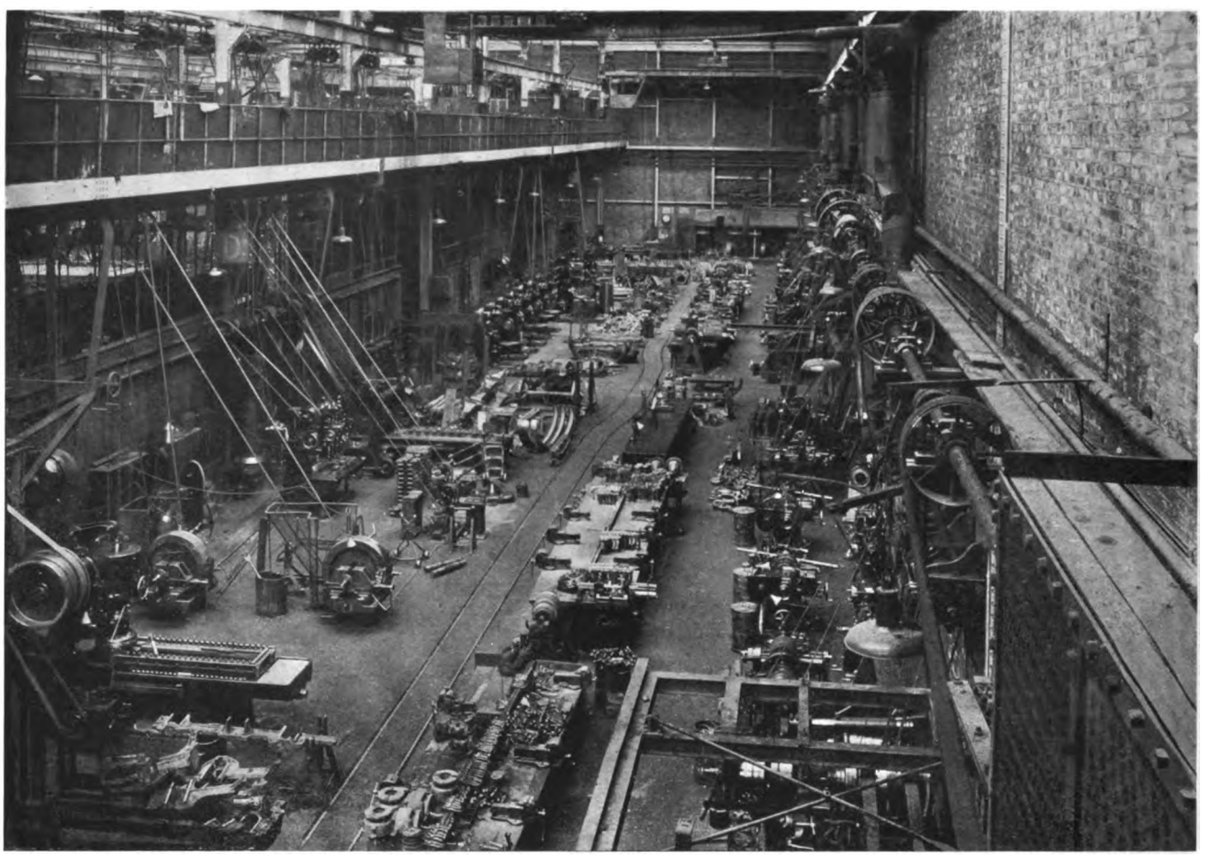
In the north-west corner of the depot is the wood-working shop, with a timber store above. An electric welding plant is installed in the northern portion of the depot, where worn iron and steel parts are built up by the electric arc process. Mess-rooms are provided for the employees.

The large block on the left-hand side of the main gateway was used by the Government during the war for the inspection of war materials; this is at present used as a plough and controller shop, but will be utilised as mess and recreation rooms when the final depot is completed. A large site at the southern end of the depot is to be built upon immediately, and will be used as the central stores for the tramways department.

Power is obtained from the Council's power station at Greenwich, and is transformed in a sub-station adjoining the mess-rooms. The heating is carried out by a high pressure steam system obtained from wet back marine boilers, which are installed above the smiths' shop.

The whole of the trucks used on the tramway system are dealt with at the depot, but owing to there being no physical junction between the northern and southern systems of the tramways capable of taking the top covered cars, only the southern system bodies can be dealt with at this depot at present.

In addition to the cars, motor vehicles are also repaired, as well as the large number of small trucks, etc., used in the undertaking.



The Machine Shop, with Works Track in the Centre.

When the equipment is completed there will be about five hundred machines of various descriptions installed in the complete depot, and approximately 500 yards of shafting driven by motors of a total horse-power of six hundred.

The Power Station.

The fourth of the reciprocating engine sets at Greenwich power station is now being dismantled, and it will be replaced by a further large turbo-generator set. Three of the reciprocating engines have already been replaced by turbine sets. Originally there were four turbines of 6,000 kw. each, and four reciprocating engines of 3,500 kw. each, and it is the last of the latter which is now being replaced. The river end of the station will then have four turbo-generators of a maximum capacity of 10,000 kw. each, while the south end has the original four of 6,000 kw. each.

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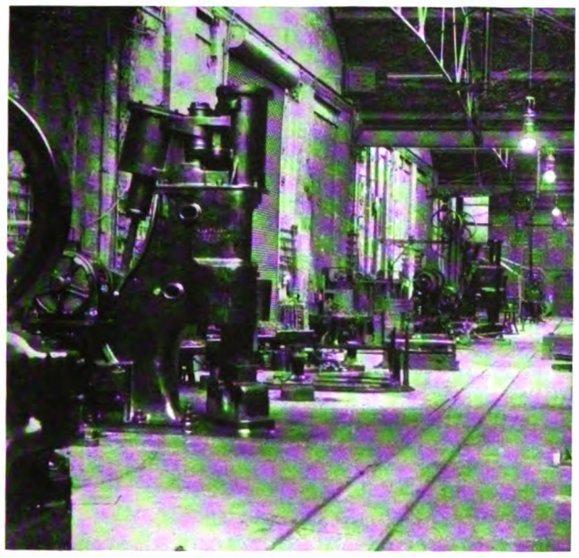
Energy is generated at a pressure of 6,600 volts, and is dealt with by electrically-operated remote control switchgear. The main and section bus-bars are in cubicles, and are operated by push button switches from the control deck. The high tension cables go to sub-stations in various parts of London, and in these the energy is transformed to 550 volt direct current.

The boiler-house has 48 boilers. Some of these at the river end of the station, which was the part first erected, are of small size, and they are about to be replaced by large modern units. Four of the large boilers at the south end are fitted for burning oil fuel; all the others have chain grate coal stokers. Above the boilers are situated the economisers and the coal storage bunkers, which have a capacity of 12,000 tons. The requirements of the station are about 3,500 tons of coal per week. The pier can accommodate coal steamers up to 2,000 tons. All coal is unloaded by electric cranes and grabs.

The entire station occupies a site of about three and three-quarter acres. It has four large chimneys, two 250 ft. high and two 280 ft. high. The difference in height is explained by the fact that it was found that if the shorter chimneys were carried higher it would interfere with certain work at the Greenwich Observatory.



The Smiths' Shop, showing Pneumatic Power Hammers.

INCREASING HEADROOM FOR L.C.C. CARS.

A Difficult Piece of Track Reconstruction.

To enable the cars equipped for both the overhead trolley and the conduit system to pass under railway bridges on the Clapham and Balham high roads, the double tracks of the London County Council Tramways have had to be lowered. It was determined to do this without interfering in any way with the tramway traffic—a very difficult operation which was carried out without injury either to the men, to the rolling stock, or to the permanent way. The awkwardness of the problem will be realised by the fact that 68 cars were running per hour for about five hours of each day and 40 cars per hour for the remainder of the day. During the night four hours were available with only a half-hourly interruption by the night car services, and on Sundays there was no traffic between 1 a.m. and 7 a.m. At the Clapham Road bridge under the S.E. and C. Railway the line had to be lowered eight inches. This involved altering the tracks for 200 yards, including the level portion under the bridge and the two approach gradients. The conduit extended to a depth of 2 ft. 9 in., and as it is formed of concrete, in which cast-iron yokes at intervals of 3 ft. 9 in. are embedded in order to form and strengthen the structure and support the slot rails, the whole is of a very rigid type. The operations had to be carried out during the past winter in order that the lowered roadway might be available for new car services in the early spring.

The work was very slow owing to interruptions by passing cars, which meant that the workmen and their tools were moved from the trenches on 40 to 60 occasions per hour. One track was lowered before the other was interfered with. In the first place the paving was removed during the daytime, and the concrete below it and under the running rails was broken up. Then the concrete of the conduits was broken up during the night. When the concrete was removed from under the running rails, timber packings resting on previously prepared concrete blocks were placed under them. Similar packings were also placed under the cast-iron yokes. The soil under the tramway was then excavated for an average depth of about 15 in., and the packings carrying the rails and yokes adjusted one by one to the deeper level, which now formed an excavation 4 ft. deep below the surface of the road. The sub-soil was of a clayey nature, and when the excavation was so far executed there were several wet days which made it necessary to increase the vigilance required for maintaining the packings in position, and the placing of additional packings as the others sunk into the wet subsoil. At night new yokes with extended arms were laid, and on subsequent nights new rails were attached to these yokes, lined up, and gauged in readiness for the resumption of the tramway traffic in the morning. On the first succeeding Sunday morning, packing pieces were evenly withdrawn from all packing points practically simultaneously, and the process repeated until the rails and yokes had dropped down to the required new level. This lowering process occupied about 1½ hours, the track was then secured, gauged, and lined up in readiness for the car services. During succeeding days forms were fixed between the yokes to act as centres for the conduit concrete, the yokes were surrounded with concrete, and the whole of the excavation was afterwards filled in with similar material.

The remaining operations of paving were completed during the daytime, and final adjustment to the conductor rails in the conduits finished at night time. A bank of eight cable ducts had to be lowered in the 3 ft. 6 in. between the tracks. The second track was lowered in a similar manner to the first. The lowering of gas mains and alteration of sewer entrances adjacent to the second track was done after the lowering, as they did not cross the rails. The excavation of the concrete and soil in the tramway area was greatly hampered by the necessity for keeping the conductor rails electrically alive, but the continuity of the operations was made possible by confining the work to the negative side of the conductors. When the work had to be done on the normal positive side, the polarity of the current was reversed. When the tramway

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carriageway breasts were lowered, the area under the bridge lay in a hollow, and specially frequent rail drains connected the grooves of the rails with the conduit; several open grid catch pits were suitably placed in the paving in order to carry away surface water as quickly as possible. The average daily number of men employed was about 40, during 73 days, between November 14, 1921, and March 3, 1922.

At the Balham Bridge, under the L.B. and S.C. Railway, the operations were similar to those at Clapham Road. The lowering here extended over 70 yards, and amounted to six inches in the centre portion. In addition, there were three 30 in. water mains under the track, and its lowering would have brought the construction to bear nearly on these pipes. To avoid this, concrete piers were sunk at 15 ft. intervals longitudinally, and on these the tracks rested in order to relieve the pipes from further road pressure. The average number of men employed was 33, during 51 working days.

Mr. A. L. C. Fell, general manager of the London County Council Tramways, directed the work, which was carried out under Mr. J. Welling, permanent way engineer, by direct labour. The success of the operations was due to the skilful preparation of the programme, and to the cordial co-operation of all engaged in the direction and execution of the lowering work.

SHANGHAI RAILLESS TROLLEY CARS.

The latest type of railless trolley cars of the Shanghai Electric Construction Company, Limited, is shown in the accompanying views. It will be seen that the forward portion of the vehicle is reserved for first-class and the rear section for third-class passengers, the two portions being divided by a partition. These cars were built by the company in their extensive and well-equipped works at Shanghai. The railless trolley

A Shanghai Two-Compartment Railless Trolley Car.

system, in fact, is largely used by the company in combination with their electric tramways, and they are making constant efforts still further to develop the railless system.

In the course of a lecture delivered by Mr. Donald McColl, the general manager of the company, on "Transport in Cities, with Special Reference to Shanghai," under the auspices of the Shanghai Civic League, he pointed out that his company had had a preliminary railless electric route in operation for nearly six years. "This period," he added, "is a year more than the life of the motor omnibuses, as stated by the London General Omnibus Company. Our experience shows that the efficient life of railless electric cars will be incomparably longer than that of motor omnibuses." In discussing the peculiar advantages of the railless system, Mr. McColl said that for roads which are too narrow for double track tramways and with traffic requiring more frequent services than could be run on a single track tramway, the railless

Shanghai Railless Car, showing Centre Door.

system is the most suitable. Turning to the double-deck railless vehicle, he referred in his lecture to the first of this class to be used—that designed by Mr. R. H. Wilkinson (general manager of the Bradford Corporation Tramways). On the whole, Mr. McColl concludes that the single deck railless car is more suited to conditions in Shanghai than is the double-deck type.

It appears that the Shanghai Electric Construction Company have made repeated proposals to the municipality for authority to extend the railless routes, and that although some 16 miles of additional route were approved, the terms then imposed by the Council were too onerous to be practical.

Mr. McColl said that in 1921 they carried seven million passengers per mile of route per annum. The system extended by the additional 16 miles proposed should deal with about 200 million passengers per annum. With double track throughout, a further 50 millions might be carried. At a moderate computation electric traction facilities for 400 million passengers per annum will be required in the Foreign Settlement within the next few years. This would call for from 60 to 70 miles of route. For the combined administrative areas of Shanghai probably 140 miles of route would be required to transport 700 to 800 millions of passengers per annum.

Omnibus Powers for Glasgow Corporation.—The Parliamentary Commission which has been sitting in Glasgow to consider a number of Provisional Orders promoted by local authorities, devoted considerable time to that of Glasgow Corporation. This includes clauses providing for the establishment of omnibus services in the city and within a ten-mile radius beyond the tramway termini. There was no opposition to the proposals regarding powers within the city, but in respect of those beyond the boundary, objections were made by various interests, including private motor service proprietors and railway companies. The Commissioners found the preamble proved as regarded general powers, and in respect of two only of several specified routes beyond the city. They also decided in favour of inserting the "model clause" under which the Corporation will be prohibited from manufacturing omnibuses.

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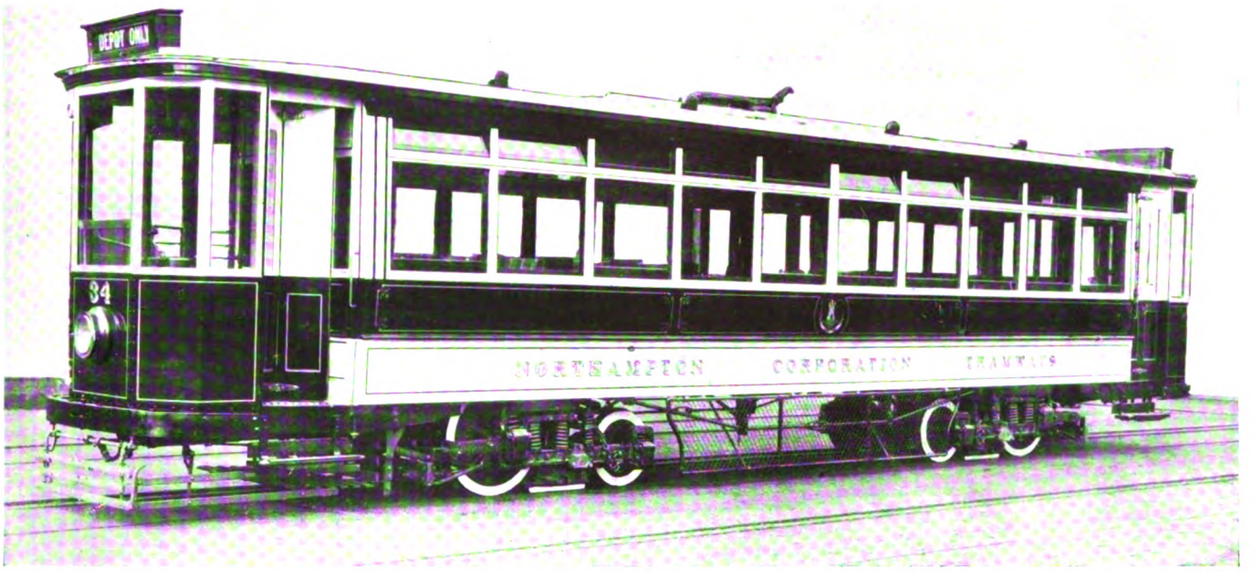
NORTHAMPTON CORPORATION TRAMWAYS.

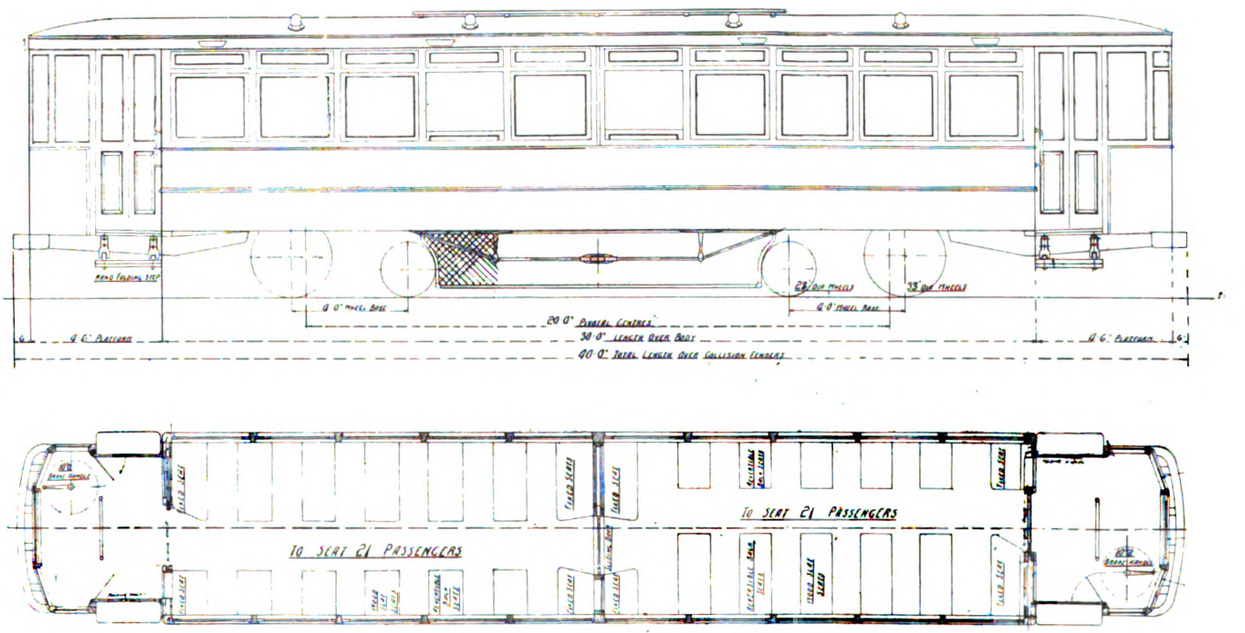
A NEW SINGLE-DECK CAR.

The new type single-deck car, which is shown in the accompanying illustration, was put into use a short time ago by the Northampton Corporation Tramways. These cars were constructed throughout at the Dick, Kerr works of the English Electric Company, Limited, at Preston, and are equipped on thoroughly up-to-date lines. The seating capacity is 42. The seats are arranged transversely, and they are of the wood slat type. With the exception of the corner seats, they have reversible backs. Smoking and non-smoking compartments, separated by a sliding door, are provided. The motorman is fully protected, having a compartment entirely to himself. The passengers' exit door is at the near side of the forward end of the car, and is of the folding type. The step to this door is also made to fold, and is operated by the driver through a lever situated near the controller. The car is fitted with pony wheel trucks, with magnetic track brakes between the pony and driving wheels. Back sanding gear is installed, so that in case of a brake failure when climbing a hill, the motorman can drop sand in front of the wheels.



New Single-Deck Car of Northampton Corporation Tramways.

The car is well lighted and amply ventilated. Ten drop lights are fitted along each side of the body, and over each is a hinged ventilator. The front light of the motorman's compartment is also made to fall. Air extractors, similar to those on railway carriages, are fixed in the roof. The life guards are of the



Elevation and Plan of New Single-Deck Car—Northampton Corporation Tramways.

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Hudson and Bowring type, the side guards of the Philipson pattern, while the space between the pony wheels is protected by a wire guard. The dimensions of the car, which is 13 feet longer than the Corporation's earlier type, are as follows—

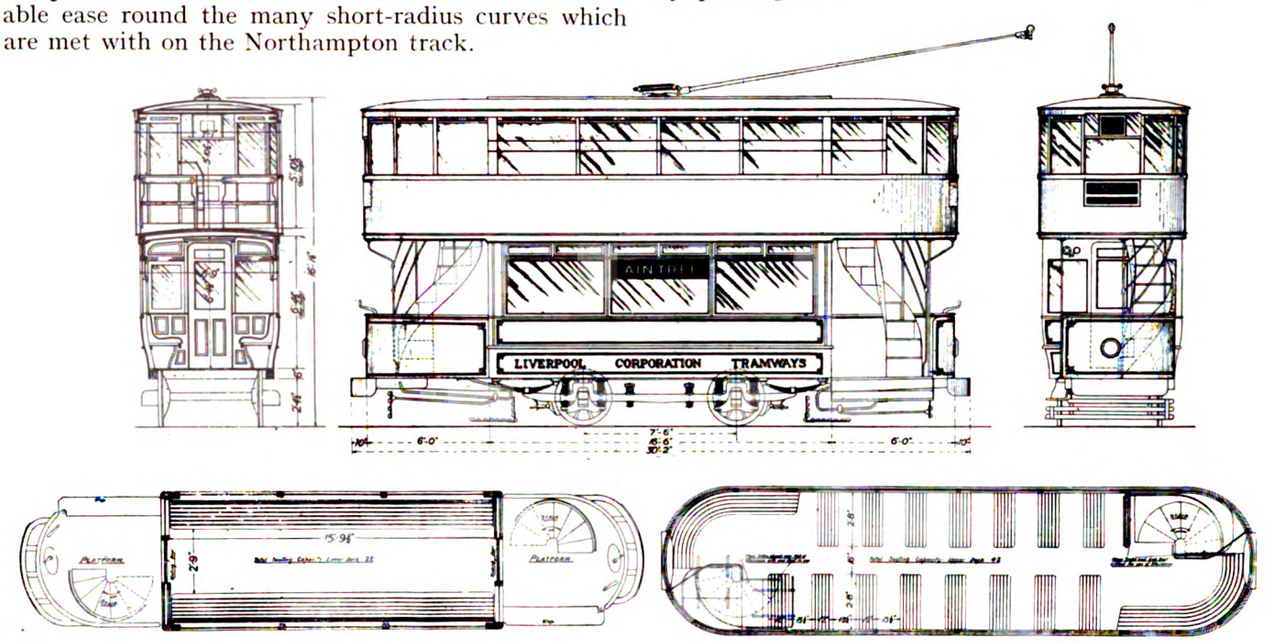
Overall length (over collision fenders)	40 ft.	Clear height, inside	6 ft. 9 in.
Length over body	30 ft.	Width	6 ft. 3 in.
Platforms	4 ft. 6 in.	Diameter of driving wheels	2 ft. 9 in.
Pivotal centres ...	20 ft.	Diameter of pony wheels	1 ft. 11 in.
Wheel bases ...	4 ft.	Gauge	3 ft. 6 in.
Total height ...	10 ft.		

On the whole, the car presents a pleasing appearance, and the engineer and general manager of the tramways, Mr. John F. Cameron, states that it rides with remarkable ease round the many short-radius curves which are met with on the Northampton track.

LIVERPOOL CORPORATION TRAMWAYS.

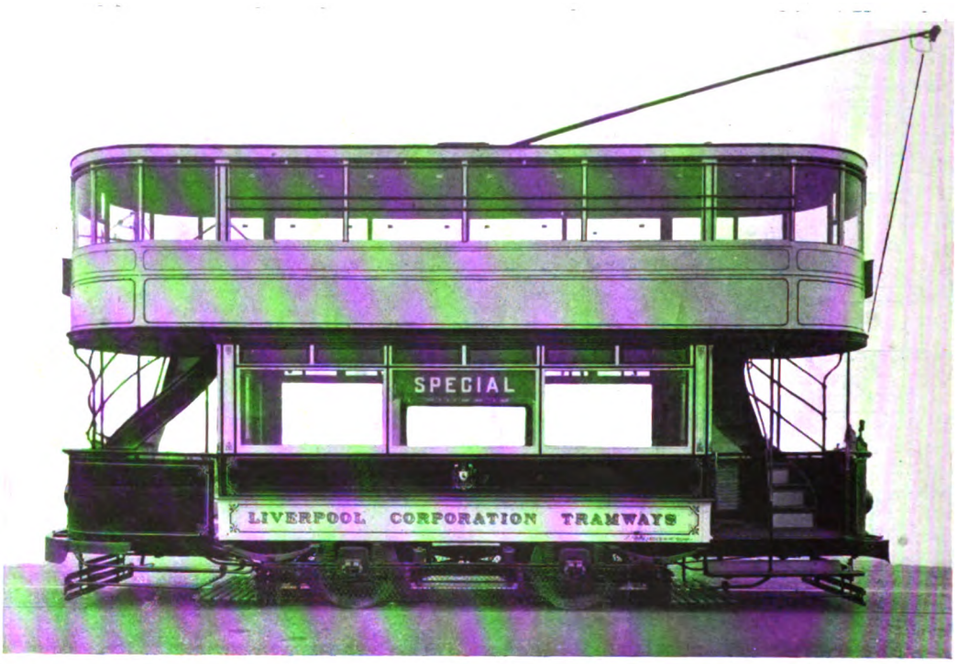
An Improvement in Car Design.

The accompanying illustrations are of a new type of top-deck vestibule car constructed by Liverpool Corporation Tramways department to the designs of Mr. P. Priestly, the general manager. This car is almost identical with the type illustrated and described in our issue of August 18, 1921. The principal difference is that on the later car the end vestibules of the upper deck are completely enclosed with glass screens—an improvement which will doubtless be appreciated by passengers.



Elevation and Plan of New Car of Liverpool Corporation Tramways.

End View.
Showing enclosed upper vestibule.



New Car of Liverpool Corporation Tramways.

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MELBOURNE AND METROPOLITAN TRAMWAYS BOARD.

The report of the Melbourne and Metropolitan Tramways Board for the year ended June 30, 1921, mentions that under an amending Act the Board is now enabled, pending the adoption of a general scheme, to deal with the question of tramways urgently required. Under the principal Act the Board could not make proposals for new tramways until it had prepared a scheme for tramway development as a whole. The total debenture liabilities of the undertaking now amount to £1,334,088. To provide funds for the Footscray and the Preston electric tramways, additional rolling stock, plant, etc., a loan of £100,000 at par for a period of five years at 6½ per cent. has been arranged with the State Savings Bank of Victoria.

During the year the traffic returns were adversely affected by several industrial disturbances. By order of the Coal Board, and arising out of the strike of stewards and seamen, all tramway traffic was suspended after 7 p.m. on weekdays, and entirely discontinued on Sundays between January 5 and February 28, 1921. The traffic receipts totalled £1,615,107 (an increase of £143,167), and it is estimated that the net loss to the Board through the strike was approximately £40,000.

To meet the increased cost of operation and standing charges an increase in fares was made on March 7, 1921, and overlapping sections were abolished. The average distance which may be travelled for a penny on the cable tramways is 1·44 miles, and on the electric lines 1·17 miles. Tokens are sold to passengers on the electric tramways at the rate of four for 6d. These tokens are very light, four or five being the same weight as a halfpenny coin. As about 45 per cent. of the electric tramway passengers pay single section fares, say 1½d., it is believed that the use of the tokens will be readily adopted by passengers.

The net revenue from the cable system was £303,314, and from the electric lines £98,794, a total of £402,108. After providing for interest, redemption of loans and sinking fund, sick pay allowances, contributions to employees' benefit society, and to War Loan applications, there was a balance of £270,693. The cost of electrical energy during the year averaged 1·152d. per kelvin, and the average consumption for traction and car lighting per car-mile was 2·32d. The operating costs were largely increased during the year by several awards of the Court of Conciliation and Arbitration, which raised wages.

The number of cars in service on the various systems was as follows—Cable tramways—573 dummy cars, 529 standard cars, and 58 bogie cars; Eastern and Northern electric systems—125 single truck cars, and 48 bogie cars.

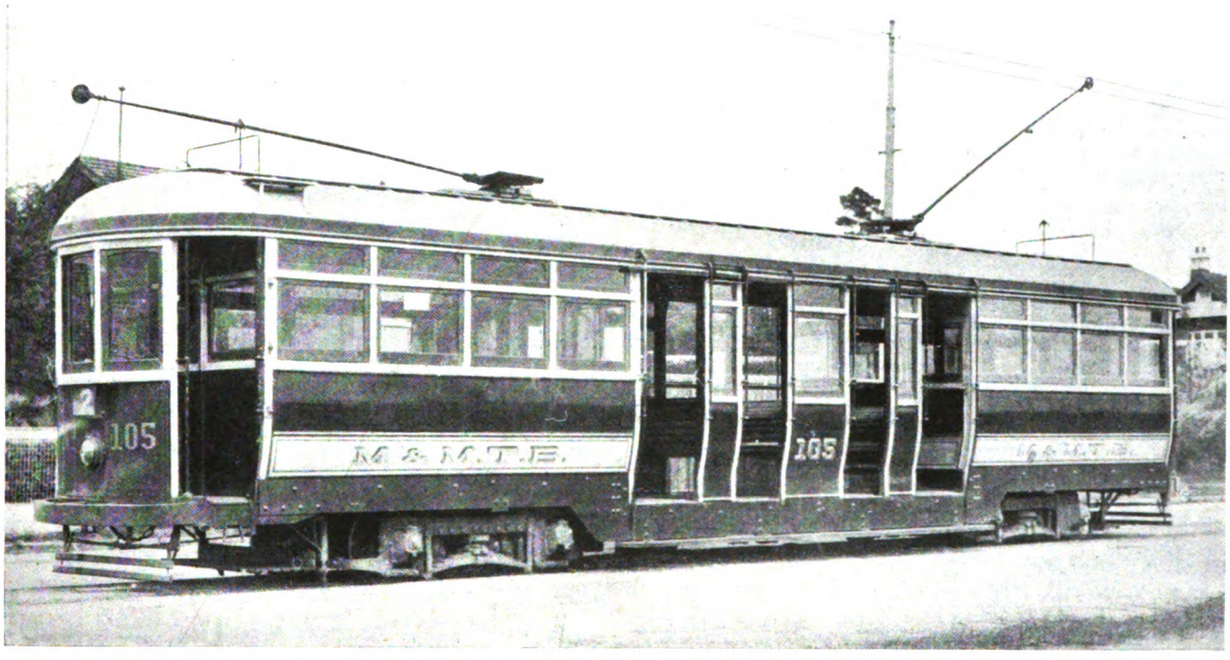
A special staff was engaged during the year in collecting and recording statistical information necessary for the formulation of a general scheme of tramway development which the Board has under consideration.

The officers of the Board are as follows—Messrs. Alex. Cameron (chairman), Alderman W. W. Cabena, Colin Templeton, T. O'L. Reynolds, Hon. J. G. Membrey, E. H. Willis, Councillor H. H. Bell, W. O. Strangward (secretary), H. S. Dix (chief manager and acting chief engineer), J. G. Roberts (manager, cable system), S. Robertson (manager, eastern electric system), M. K. Westcott (manager, northern electric system), C. Andrews (treasurer and accountant).

The following statistical information is appended to the report—

Population served by tramways	632,000
Journeys per head of population per annum ...	332

	Cable.	Electric.
Gross capital expenditure	£2,124,629	£1,697,147
Mileage of double track	45·9	45
Mileage of single track	—	19·4
Traffic receipts	£1,145,335	£469,772
Total revenue	£1,147,747	£473,013
Working expenses	£844,433	£374,219
Balance of revenue over operating expenses	£303,314	£98,794
Tram miles	14,068,981	5,808,785
Passengers carried	149,048,681	60,898,641
Average maximum number of cars in use daily	456	136
Percentage of working expenses to total revenue	73·6	79·1
Average traffic receipts per car-mile ...	19·538d.	19·409d.
Average traffic receipts per mile of single track	£12,309	£4,298
Average traffic receipts per passenger...	1·84d.	1·85d
Average total receipts per car-mile ...	19·58d.	19·54d.
Average speed per hour, including stops	9 miles	10 miles
Average working expenses per tram mile—		
Excluding power cost	11·128d.	12·790d.
Including power cost	14·405d.	15·462d.
Scale of fares	1d. to 3½d.	1d. to 7d.
Average distance per penny fare ...	1·44 miles	1·17 miles
Average passengers per tram mile ...	10·59	10·48
Number of cars in stock	587	173
Number of dummies in stock	573	—
Average number of kelvins used per tram-mile	—	2·32
Average cost of current per kelvin ...	—	1·15d.
Number of employees	2,836	1,275



New Bogie Car, with Central Entrance, of Melbourne and Metropolitan Tramways Board

Increasing Popularity of the One-Man Car in the U.S.A.—One of the most recent pronouncements in favour of the one-man car is that of the United Electric Railways of Providence, Rhode Island, who propose to use one-man safety cars on one city and seven suburban routes. New cars will be purchased and some old cars converted to the one-man operation.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, APRIL 13, 1922.

Electric Railway Development.

Events continue to shape themselves in such a way that an early beginning of large electric railway development in London and the south-east of England may be expected. In the latter part of March the official announcement was made that the Treasury had agreed to guarantee a loan of £5,000,000 to be raised by the London Electric and the City and South London Railway Companies for the purpose of carrying out their long-contemplated extensions and improvements. Provision for making such State guarantees is set out in the Trade Facilities Act of 1921, which was passed for the purpose of promoting useful works the construction of which would relieve the prevalent unemployment. It is certain that the widening of the tunnels of the City and South London Railway, the building of a new extension line from Hampstead to Edgware, and the construction of certain connecting links will give employment for many men; the number has been estimated at from 15,000 to 20,000. When the works are completed the London travelling public will find their facilities much improved. The railway companies on their part will have a considerably lower rate of interest to pay on the new capital than if it had been raised by loan in the ordinary way, while they may hope for a considerable increase of revenue. The scheme for the further electrification of the suburban lines of the London and Brighton Railway and for a beginning of the conversion of the suburban lines of the South Eastern and Chatham Railway has also been advanced by an agreement arrived at between these two companies and the London and South Western Railway regarding methods of electric traction. The South Eastern Company estimate an expenditure of nearly six millions sterling on the electrification, the first stage of which will cover 210 miles of suburban tracks. Some ten millions in all will be required to electrify about 300 track miles of suburban lines of the Brighton system. How long it will be before these great projects are fully put in hand and completed remains to be seen.

Realisation of a Long Deferred Project.

The announcement made recently that the London County Council cars will commence running early in May between the Thames bridges and Wimbledon by way of the London United Tramways lines at Tooting and Merton recalls to mind that the initiative in this much needed improvement in tramway service in south-west London was first taken fifteen years ago by the late Sir Clifton Robinson, the then managing director of the London United Tramways. Shortly after the opening of the London United Tramways lines in Wimbledon and Tooting in 1907, Sir Clifton sought Parliamentary powers for the construction of the few yards of line required to connect the dead ends of the two systems at Tooting, and for the right to work the London United Tramways cars through to Westminster Bridge. In return for this concession the London County Council cars were to run through from the bridges to Wimbledon, Kingston, and Hampton Court. Strange to say this commonsense scheme was strongly opposed by the London County Council and by that section of the London press which is most clamorous nowadays for the extension and linking up of the tramway services of the Metropolis. The opponents of the scheme put forward the allegation that in return for allowing the London United Tramways cars to run through the thickly

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populated districts of the county area the Council's cars would traverse thinly populated and semi-rural regions. A service of London County Council cars to Hampton Court from Westminster Bridge was scoffed at, and the opposition waxed scornful at the very suggestion of the cars of a private company being allowed to run over municipal lines. Those familiar with the recent history of tramway operations in the Metropolis will readily agree that Sir Clifton Robinson's proposals for interchange traffic between the London County Council and London United Tramways systems would have proved advantageous to both the undertakings concerned, as well as to the travelling public. In the present condition of London traffic, any measure of prosperity that awaits tramway operations can be obtained only through the closest co-operation among the various systems working in the London area, and the linking up of dead ends wherever practicable. The arrangement under which the Council's cars will work through to Wimbledon is not exactly analogous with the proposals that were put forward by Sir Clifton Robinson, but are rather in the nature of a compromise arising from the Council's taking over of the London United Tramways lines in the county area at Hammersmith. In return for being allowed to work through to Hammersmith and Shepherd's Bush over the lines acquired by the Council, the London United Tramways Company will relinquish to the London County Council the entire operation of the London United Tramways lines in Wimbledon and Tooting. When the dead end of the old London United Tramways line at Hammersmith is linked up with the London County Council Harrow-Road Wandsworth line, the Council will run services of cars through to Kew Bridge, and a journey by tram from Kew to Putney and Wandsworth without change will then be practicable.

Industrial Disputes. In times of depression as in those of prosperity industrial troubles are always with us. It is not altogether a disadvantage that there should be differences of opinion; but the practical working out of these differences as we see it to-day is thoroughly bad. The evil effects of the succession of strikes and lock-outs are patent to everyone. The time wasted causes loss of material wealth to the community, most of all to those directly concerned; the atmosphere of doubt and uncertainty continually maintained handicaps our merchants abroad in their uphill fight against countries having every advantage of exchange; finally the atmosphere of strife and class hatred deliberately fostered by a small section is aggravated by industrial contests the rights and wrongs of which it is frequently impossible to ascertain with any precision. The actual development of each struggle is a matter of crowd psychology. Insistent carpings at those in authority, misrepresentations of mistakes committed, a seemingly unselfish appeal to stand up for class rather than personal interests, or the pursuit of some obscure social ideal, are all invoked to bring about a state of exasperation which any trivial incident will transform into active hostilities. The pity of it is that these hostilities, when they come, cannot in one slightest respect improve the situation of either party. In the end they will have to accept a settlement which, as far as material conditions go, was just as possible at the beginning, with the meagre consolation which all beaten parties seem able to gather that they have somehow or other maintained some "honour" intact. It is a sad reflection that all the disturbance is really so futile, but it can be repeatedly seen in the course of any dispute. As soon as the enthusiasm has worn off, the original pretext of the dispute either falls into oblivion or is wrapped up in an impenetrable mist of explanations, and the last half of the dispute drags out in an undignified search for a face-saving formula. How, then, can we explain the recurrence of these ugly manifestations at once so harmful and so unavailing for any purposes of good? It is the social system, we are told. But can anyone conceive of any system doing better where good will is lacking? Do the methods of another system, now exemplified in Russia, seem likely to be kinder or more conducive to the public weal? Such a position can never be maintained by argument; it is unthinking temperamental anarchism with which we have to contend. This small section, divided as it is between a thousand policies for constructive purposes, is none the less at one and in deadly earnest in the sole determination

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to subvert the existing state of things. Filled with anger by some mystic revelation of the shortcomings of capitalism, their mission is to overthrow it, lock, stock and barrel. They are nothing if not thorough; their object can be most promptly achieved after the pattern of their continental masters by destructive revolution. As the citizens of this country are not disposed to be stampeded into anything of that kind, less "ideal" methods must be employed; the present system must be made unworkable from within. In pursuit of this plan every industry is tackled as opportunity arises; seeds of disunion are scattered broadcast; wherever they find suitable ground manure is at once provided, and a crop of troubles raised. The greater the disorganisation resulting, the more successful is the attempt considered. The actual settlement is of little account, provided it has been postponed as long as possible. In fact, the more bitter the feeling left the better; it will be easier to begin again. In the meantime much dirt has been thrown into the cogs; one day the wheels will cease to go round. This, in short, is the danger which organised labour has now to face. It has done great service to the community in the past by improving the position of the labourer and rooting out abuses; if it is to maintain its usefulness it has now to combat this insidious movement against its own welfare and the liberty of the citizen that has already secured a fighting foothold in its own ranks.

MELBOURNE TRAMWAYS ELECTRIFICATION.

Conversion of Cable Lines.

Plans are being prepared by the Melbourne (Australia) Metropolitan Tramways Board for the electrification of the cable lines which constitute more than half their total track mileage. The Board controls all the tramways within the Metropolitan area, serving a population of over 600,000. Their engineers have, *The Times* reports, been engaged for some time upon a complete scheme, which, it is recognised, must be decided upon before any individual conversions are undertaken. The conversion of the cable lines cannot be undertaken as a single job.

The electric tramways will be gradually brought into the city, one line at a time, until the conversion of the obsolete cable system is complete. A great deal of work is involved in such a scheme. It is the business of the engineers not only to provide for present tramway needs, but also to take into consideration such factors as the growth and development of districts and the possible needs of 20 years hence.

The first part of the conversion scheme will be the extension of the present electric termini to the city. When the plans are complete they will be submitted to the Parliamentary Railways Standing Committee, the function of which is to investigate all railway and tramway construction propositions. It is the practice of the Government and Parliament to adopt the Committee's recommendations.

TRAMWAY AGREEMENT OF MARCH, 1922.

In the Journal of the Municipal Tramways Association for April Mr. J. Beckett, the general secretary, makes the following comment on the agreement made between the tramway employers and employees on March 9, 1922, given in our issue of March 16 last:—

"On March 9, 1922, almost three years after the first National Agreement was made, the National Council adopted with unanimity the terms of a new agreement, after seven days' negotiation, during which time every aspect of the conditions of service for tramwaymen was thoroughly examined and sifted. The members may take it that the new terms represent the best compromise that could be made with the goodwill and consent of both parties, and all parties are now invited by their representatives upon the National Council to adopt them. So far as the men are concerned, their representatives on the National Council—eighteen out of twenty-two who were present—voted in favour of the terms, and they will recommend their adoption. We may reasonably count upon acceptance by them.

"So far as municipal tramways are concerned, it is not proposed to convene another special general meeting of the Association. Their representatives have done their utmost to give effect to the decision of the last special general meeting, which was held on December 9 last. Those representatives now appeal to all the constituents of the Association to put the terms into force as and from the commencement of the first full pay period after April 17, 1922, and they rely upon their loyalty and co-operation. During these prolonged negotiations Mr. Fearnley has occupied the onerous position of spokesman for the representatives of municipal tramways, and, by common consent, has discharged his duties with conspicuous ability and success. It is not putting it too high to say that the whole industry is indebted to him for the sacrifice he has made during recent weeks in the common interest."

RATIFICATION OF THE AGREEMENT.

At a meeting of the National Joint Council the resignation of Mr. W. J. Squires was accepted with regret, and the best thanks of the Council were accorded to him for his splendid services as chairman of the Council since it was formed. Mr. J. M. McElroy's resignation was also accepted with regret, and the Council placed on record their appreciation of his services and untiring devotion to its interests. M. A. L. C. Fell and Mr. John Barnard were elected members of the Council.

Reports of the constituent associations respecting the revised agreement were received. Mr. Fearnley reported that there was no dissentient among the municipal tramway authorities, and Mr. Tegetmeier reported that the conference of tramway and light railway companies had recommended to the companies concerned the adoption of the agreement. Mr. Cliff reported that the employees had by a majority decided to accept the agreement.

A question was raised as to the meaning of the words, "this date," referred to in Clause 2 (*a*) of the revised agreement, and it was resolved that the words "this date," be construed as the date of the signing of the agreement, viz., April 11, 1922.

The committee recommended that the terms and conditions of service of the permanent way employees who had been working under the March 1919, agreement, should be the subject of local negotiation and agreement between the undertakings concerned and the trade union representatives.

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FUTURE OF LIGHT RAILWAYS.

REPORT OF INVESTIGATION COMMITTEE.

We give below a summary of the valuable report on the present condition and future prospects of light railways in the United Kingdom which the Light Railways (Investigation) Committee prepared for the Minister of Transport. It is dated 1921, and occupies nearly 26 pages. The report, together with the separate appendices, has been issued by H.M. Stationery Office.

The constitution of the committee was as follows—

Sir ALEXANDER GIBB, G.B.E., C.B., Director-General of Civil Engineering, Ministry of Transport, chairman.
Sir WILLIAM M. ACWORTH.
Sir JOHN A. F. ASPINALL, M.Inst.C.E., M.I.Mech.E., Consulting Mechanical Engineer, Ministry of Transport.
Mr. V. M. BARRINGTON-WARD, D.S.O., M.Inst.T., Traffic Department, Ministry of Transport.
Mr. T. CARTWRIGHT, Bishop's Castle Railway, Shropshire (unable to attend meetings, and therefore not a signatory).
Mr. C. E. DREWETT, Lynton and Barnstaple Railway Company.
Lieut.-Colonel J. A. S. GRAY, C.M.G., D.S.O., Development and Engineering Department, Ministry of Transport.
Mr. W. T. D. GRUNDY, Derwent Valley Railway, York.
Mr. A. H. LORING, East Kent Railway.
Mr. E. W. OAKLEY, Saundersfoot Railway and Harbour Company, Glamorgan.
Colonel J. W. PRINGLE, C.B., R.E., Chief Inspecting Officer of Railways, Ministry of Transport.
Lieut.-Colonel H. F. STEPHENS, chairman of Associated Railways, Tonbridge, Kent.
Mr J. R. DEANS, Ministry of Transport, secretary.

The terms of reference of the committee were—"To examine and report upon the future policy and development of Light Railways operation and construction in the United Kingdom, due regard being given to the possibility of utilising roads for mechanical transport as an alternative, and as a preliminary to submit full information as to continental methods," with particular reference to certain points mentioned in a subjoined list. At the outset of the report the signatories recall that they were appointed in March 1920, and they proceed immediately to summarise the conclusions and recommendations at which they have arrived.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

1. We are in complete agreement with the proposal to transfer the powers of the Light Railway Commissioners to the Minister of Transport.

2. When an application for a Light Railway Order is rejected on grounds other than non-compliance with the rules of procedure, promoters should have a right of appeal to Parliament on payment of an additional fee, but the notices published and served and the deposits made for the purpose of the application should be held to suffice for the purpose of the appeal.

3. (a) Requests for State assistance under Section 17 of the Ministry of Transport Act, 1919, should be considered on their merits, and without reference to the conditions on which Treasury advances have been made under the Light Railways Act, 1896.

(b) The Minister of Transport should have power to subscribe to the share capital of, as well as to make a grant or loan to, a light railway company.

4. No ampler provision than that contained in Section 11 (f) of the Act of 1896 is necessary for the representation of a local authority on the managing body of a light railway company to which it has made an advance.

5. We welcome the amendment which has been inserted in the Railways Bill, under which (a) local authorities would be empowered to guarantee interest on the capital of light railway companies, and (b) Section 11 (f) of the Act of 1896 would be made to apply to cases in which such guarantees were given.

6. The Minister of Transport should have some voice with regard to the design of any light railway which receives assistance in future from public funds; and where this assistance is rendered in the shape of subscriptions to share capital, the State or the local authority so subscribing should possess the ordinary rights of shareholders.

7. Where it is proposed to acquire land compulsorily for light railway purposes—

(a) The rules for the assessment of compensation which are contained in Clause 2 of the Acquisition of Land (Assessment of Compensation) Act, 1919, should be made to apply.

(b) Promoters should have power to acquire an easement only, where such would be sufficient for the purposes of the undertaking.

(c) Subject to such conditions as may be imposed in special cases, promoters should have an unrestricted power to hold or dispose of surplus land.

We note with satisfaction that, so far as they relate to the customary allowance of 10 per cent., and to the holding and disposal of surplus land, the foregoing recommendations could be carried into effect under Clause 68 of the Railways Bill.

8. The principle of betterment should be more widely recognised and the application thereof should not necessarily be limited to the owner of the property which is to be compulsorily acquired.

9. Future policy should aim at encouraging light railway undertakings by the grant of special facilities by the State and by the larger railway companies. Closer concentration upon this object would tend to obviate or reduce the demand for direct pecuniary assistance from public funds.

10. The poor financial results obtained from light railways in Great Britain have been mainly due, not to failure to exercise economy in working expenses, but to the smallness of the earnings in relation to the capital involved.

11. The possibility of exempting light railway companies from the payment of Corporation Profits Tax should be seriously considered.

12. The revision of the rating of railways should now be seriously considered, with particular reference to the incidence of highway rates.

13. (a) Small undertakings desiring to be classified as "light" railways, and main line companies who may desire certain sections of their undertakings to be so classified, should be able to attain this object without difficulty and with the minimum of expense.

(b) The relative procedure should be as simple as possible, and payment of the fee of £50 which has usually been demanded should no longer be required.

14. (a) Where no connection with a main line is possible, or likely to be required, the choice of the gauge for a new light railway may be determined mainly by considerations of economy in construction and maintenance. Where connection with a main line is proposed or may ultimately be necessary, a narrow gauge should not as a rule be adopted unless the light railway is to have a lead exceeding 20 miles or is to form part of an existing narrow gauge system which could not advantageously be converted to standard gauge.

(b) For narrow gauge lines the dimension of 2 ft. 6 in. should in future be regarded as the standard.

15. Light railways should be classified in two groups with particular reference to the maximum speed authorised for each. This maximum should be 25 miles per hour for lines in Group I. and 15 miles per hour—or such lower maximum as may be agreed to by the Minister of Transport—for lines in Group II.

16. (a) Weights of rail and axle loads permissible should be determined by reference to a sliding scale to be inserted in Appendix VII. to the Requirements with regard to the Opening of Railways, due regard being had to speed, alignment, and traffic conditions. (This suggestion, it is stated in the report, has since been accepted by the committee concerned.)

(b) The power to sanction departures from the sliding scale in special cases should be reserved to the Minister of Transport.

17. (a) Complete schedules of up-to-date model clauses for insertion in draft Light Railway Orders should be printed and made available for the use of promoters, subject to the proviso that the schedule of requirements appended to each order should be left open for settlement on the merits of each case.

(b) The requirements usually specified in this schedule with regard to signalling, points, and cognate matters could not safely be relaxed in favour of the "higher speed" lines included in Group I.; but on the "lower speed" lines included in Group II. no signals should, as a rule, be required.

18. (a) Fencing should be provided only where local conditions, including the speed of trains, render it absolutely essential; and the protection of level crossings by gates and gatekeepers should be similarly limited. (We have indicated in the body of our report the alternative protective measures which should suffice.)

(b) In any case where additional protection may become necessary at a crossing after a line has been opened for traffic the appropriate Government department should have power at any time to require the company to provide such additional protection.

19. (a) Where a road and light railway intersect, a bridge should not be provided except where no economy could be effected by the provision of a level crossing, or where other conditions render a bridge essential.

(b) Undue weight should not be allowed to the arguments adduced by local authorities in pressing for the provision of bridges in lieu of level crossings.

20. (a) Station accommodation for passenger traffic should be more strictly limited, and should take the form of a simple shelter except at important stations. Halts should suffice at wayside places, and wherever it is practicable tickets, fares, and "stamped" parcels traffic should be dealt with by the train guards.

(b) The station facilities provided for dealing with freight traffic should be more closely adjusted to the requirements.

21. Where a new light railway is proposed the question of dispensing with platforms should be considered, especially in the case of a narrow gauge line, where the use of second-hand main line rolling stock is necessarily precluded.

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22. If, on the security of public guarantees, the capital of new light railways were obtainable at par, expenditure on construction would be reduced, and many undertakings which could not otherwise pay a dividend on their ordinary shares would be able to do so.

23. (a) The quantities of rolling stock initially provided for light railways should be more closely adjusted to the traffic requirements.

(b) A determined effort should be made to secure economy in respect of rolling stock by a standardisation of types and parts.

24. Economy may be effected, and traffic increased, by the use of steam or internal combustion rail motor cars for passenger services.

25. Where two classes of passenger accommodation are provided, an unduly high proportion of the total is sometimes allocated to first-class passengers. In many cases the provision of two classes is unnecessary.

26. Advantage would result from a wider use of railway vehicles on tramway tracks. Provided that suitable regulations are applied, and that local conditions render it practicable, we see no reason why tracks on a public road or street should not be used for this purpose.

27. Greater economy is desirable in methods of maintenance and operation; and existing facilities for the handling of traffic should be improved, e.g., by the extension of sidings and other working facilities at stations and exchange points. In this connection the co-operation of main line companies would be of much assistance, and would also benefit the larger companies themselves. Co-operation on the part of the Ministry of Transport, with regard to methods of construction, maintenance, and operation, would also have valuable results, and the readiness of the Ministry to investigate and assist in such cases should be made more widely known.

28. In present circumstances the *Formules d'Exploitation* which have been adopted in France would be inapplicable in Great Britain.

29. (a) We note that the Railways Bill provides for the absorption of certain existing light railways into "amalgamated companies." We suggest that, after the Bill has been passed, the Minister should consider the propriety of encouraging the separation from the main lines of undertakings which are really "light railways."

(b) If Clause 72 of the Railways Bill becomes law, an application by a railway company for an amending order empowering it to acquire a light railway should be granted by the Minister only if he is satisfied that the light railway concerned has changed in character and become competitive; and the order should provide for fair terms of purchase, to be settled in case of difference by arbitration.

30. The principle of voluntary "grouping" of light railway undertakings for purposes of management should be extended. Even where this is impracticable, there should be a closer co-operation in matters affecting the design and repair of rolling stock and permanent way material. Where an undertaking is so located that it could not benefit from a centralisation of repair work, it should at least endeavour to realise economies by the co-operative purchase of materials and stores.

31. Light railways should be emancipated from the influence of the existing standards by which the cost of labour is determined. This cost should be far more closely related to the quality and quantity of the services rendered and to the revenue derivable therefrom.

32. Claims for compensation in respect of loss suffered by light railway companies by reason of the high cost of labour (and said to be due to the action of the Government) should be seriously entertained.

33. Rates and fares should be determined in each case by reference to the economic circumstances of the particular line concerned; and in the apportionment of through rates and fares also, each case should be dealt with on its merits. In this connection the wide difference in the economic positions of light and main line railways respectively should be a basis of consideration, and the general principle that revenue should be sufficient to yield a reasonable return on capital should be borne in mind. In particular, light railway charges should not be based upon any definite *ratio* to main line charges.

34. Light railway companies in Great Britain should be admitted as members of the clearing house, and possess all the privileges of membership except the power of voting.

35. Light railway companies should be represented on all official panels or committees which deal with matters likely to affect such undertakings.

36. Through rates are advantageous to the public, and their institution brings the light railways into closer contact with the main lines, and thereby tends to facilitate the working and exchange of traffic. They are therefore generally desirable, but in particular cases the decision with regard to the adoption of through rates must depend upon local circumstances.

37. In assessing the comparative economic values of road motor transport and light railway services, individual cases must be considered on their merits. Any attempt to direct future development in accordance with a general verdict favourable to either form of transport would be highly misleading. It must be frankly recognised that a road motor service may be a desirable alternative to a light railway, and no such railway should be authorised where it is clear that a road motor service would be equally suitable, and is likely to be established within a reasonable time. Future policy should aim at a solution of the problem by way of co-operation and co-ordination, rather than of competition, between light railway enterprise and road motor transport respectively.

38. A new conception of the character and functions of a light railway is necessary, and it should be recognised by all concerned that light railways differ essentially from main lines, and must depend for success upon the adoption of different standards of construction and operation. In this connection a lower standard of speed is a first essential.

The report states that a questionnaire was addressed to 53 typical light railways in the United Kingdom to obtain up-to-date information, and that the statements of fact supplied, and the practical suggestions offered in response, have been of the greatest value. From information drawn from the official reports of the Société Nationale des Chemins de Fer Vicinaux in Belgium, and from numerous other sources, the signatories have compiled a comprehensive statement concerning the development and practice of light railways in European countries and in India. This document has been embodied in Appendix K to the report. "In the absence of any precise definition of the term 'light railway,' we have deemed it advisable not to accept any narrow classification for the purposes of our inquiry. Differences of type and character abound, and any attempt to circumscribe our investigation in obedience to particular legal or technical distinctions would have detracted from its value. For this reason we have not confined our attention to those undertakings which have been sanctioned by specific 'light railway' legislation; we have taken cognisance also of many lines which have had a different origin but are nevertheless 'light railways' in the ordinarily accepted sense of the term." The committee also point out that having regard to the changes effected by the Government of Ireland Act 1920, the conclusions and recommendations of the committee apply to Great Britain alone.

History, Economic Position, and Prospects.

After referring to the brief history of light railway development in the United Kingdom, as given in Appendix A to the report, the committee state that the evidence before them, including that contained in the annual reports of the Light Railway Commissioners, clearly indicates that in practice the Acts of 1896 and 1912 have not served to foster the development of light railways to an extent comparable with that attained in continental countries. As regards the development and practice of light railways in continental countries, the report states that, as a general rule, the Governments of Belgium, France, and other European countries "have had a very lively conception of the benefits of light railway enterprise, and that, to a far greater extent than our own Government, they have associated themselves directly with such enterprise and have systematically fostered it.

"This intimate association between States, local authorities, and promoters is, indeed, the principal feature which distinguishes continental light railway enterprise from our own. In many instances the foreign lines to which we refer are actually owned by the State, and even where they are not so owned they are frequently subject to the closest supervision and control. We are not convinced, however, that the results achieved have on the whole been such as to prove that an attempt should be made, at this late stage, to foster light railway enterprise in the United Kingdom by the adoption of similar measures. The case of Belgium would, perhaps, appear to furnish some justification for re-fashioning our light railway system upon a continental model," though the report adds that Belgium, as a country, possesses characteristics suitable to its railway system which do not obtain to anything like the same extent in Britain. "The question of public ownership and control raises a political issue which lies outside our mandate as a committee, and we do not feel called upon to frame any recommendation thereon."

"The financial position of light railways generally in the United Kingdom, the report proceeds, is unsatisfactory. There are, it is true, a few undertakings which have attained prosperity or show promise of doing so; but these cases are unusual. Particulars of the receipts and expenditure of a large number of light railways in Great Britain and Ireland (given in Appendix B), taken from the official railway returns for 1913, show that for the last year of normal working prior to the war the great majority of the undertakings concerned yielded only a very small return upon the nominal amount of the capital raised and ranking for dividend. In an appreciable

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number of cases the year's working resulted in an actual deficit. The lines in Great Britain showed, on the average, a return of only about 2·29 per cent. on the capital, whilst even this figure would have been reduced to 1·90 per cent. by the exclusion of two standard gauge lines which carry a heavy industrial traffic and possess to some extent the character of "heavy" railways. In many instances, however, the nominal capital of a light railway company is greatly in excess of the amount of the cash actually subscribed for the construction and equipment of the railway, and that where this is the case the dividend figures do not adequately represent the actual return upon the money invested. At the outset of our inquiry we found it to be a general impression that the financial difficulties of light railways in the United Kingdom were due to the fact that the proportion of working expenses to gross receipts was much higher than in the case of the main line undertakings. The figures contained in Appendix B show that, with regard to light railways in Great Britain, this impression was erroneous. For the year 1913 the ratio in respect of the main lines worked out at 63·3 per cent., and that in respect of the light railways at 66·6 per cent., but in this connection it is only fair to add that the figures in individual cases varied very considerably."

The committee point out that future policy should no doubt aim at a development of traffic itself, and that in order to combat the adverse economic influences arising from the war, it will be necessary to simplify methods of construction, maintenance, and operation to improve exising organisation, to economise in matters affecting the employment of labour and to ensure that rates and fares shall be calculated upon an equitable basis.

Rate of Speed and Rolling Stock.

On the subject of axle loads and weights of rail in relation to speed, the committee state that light railway undertakings generally do not desire the authorisation of speed limits exceeding 25 miles per hour, and they anticipate that in many instances there would be no reluctance to accept an appreciably lower limit if it were clear that this would admit of commensurate economy in construction and operation. "We are satisfied, indeed, that in future many light railways in the United Kingdom may find that a much lower speed limit could be adopted without any real sacrifice of efficiency, and we think that there will be a tendency in this direction. The experience of Continental light railways has shown that this is practicable, and may confidently be expected to lead to considerable economies in construction, maintenance, and working."

Dealing with the cost of light railway construction and equipment, the report says that the cost at July 1921, may be taken as varying between twice and two-and-a-half times the pre-war cost; and it is anticipated that in 1922 prices will not represent, on the average, an advance of more than 100 per cent. on pre-war figures. These estimates, it is added, are, however, highly speculative.

Although as a general rule the quantity of rolling stock at present provided appears to be suitably adjusted to traffic requirements, there is reason to believe that in many cases the original equipment was either inadequate or excessive, and that the adjustments subsequently necessary have been so considerable as to involve either heavy and unforeseen expenditure upon the purchase of additional stock or appreciable loss in the disposal of surplus equipment. The promoters of new undertakings have necessarily been compelled to base their original purchases upon estimates of the probable volume of traffic to be carried, and it was to be expected that such estimates would frequently fall short of or transcend the actual requirements. Nevertheless, we think that greater exactitude might have been attained, and considerable economy effected, if the importance of this matter had been more fully realised.

The same consideration applies, and possibly with greater force, to the question of design. It has not been uncommon in the past for a new undertaking to be equipped with rolling stock of types which have been found subsequently to be unsuitable for, and to militate against, the economical working of the particular traffic. In this connection the committee have been struck by the great variety of design in the rolling stock employed on light railways generally, and are satisfied that the absence of uniformity in this matter has not only prevented undertakings in the same area from assisting each other by the interchange of stock, but has rendered the purchase, maintenance, and renewal of their stock more costly than they need have been. The possibility of common action in this connection is essentially a matter of organisation and management.

The committee refer to the suggestion that ordinary "tramways" might be more widely used for the carriage of goods, and that added advantage would be gained if the width and depth of the groove in tramway tracks were so increased as to admit of the free passage of railway rolling stock. Having regard to the fact that the present standard width and depth of the groove in these tracks have been fixed with due regard to public opinion concerning the safety of certain wheeled traffic, and that an increase in the width and depth of the groove would be necessary in order to allow of the passage of railway stock, they say it is possible that such increase might raise opposition from a certain section of the public in the case of tramways laid on public roads. It should be pointed out, however, that outside Great Britain it is usual for railway stock to be run over tracks laid on public roads and streets; and the committee were much impressed by the advantages thus secured abroad but generally denied in this country. "We think that a similar extension of transport facilities is desirable in the United Kingdom, and has been prevented partly by the traditional tendency to regard the presence of a railway vehicle upon a public road as an impropriety, and partly by opposition due to an exaggerated conception of the risk attendant upon such a use of the highway."

A complete section of the report (IV.) is devoted to road motor transport as an alternative to light railway services. "It cannot be denied," the committee state, "that railway companies generally are feeling the effects of the present competition of motor omnibus and lorry services, and as the rivalry is naturally keenest in respect of short distance traffic, it might be expected that the competitive influence would press most heavily upon the light railways. Few of these possess any considerable length of lead, and there is the further consideration that some of them make no physical connection with the neighbouring main lines, and are therefore unable to transfer traffic to those lines without transhipment. Nevertheless, although the evidence we have received indicates that road motor vehicles are in direct competition with light railway undertakings in many areas, and that the latter in consequence have experienced a certain loss of revenue, this competition has apparently failed so far to deprive them of more than a small percentage of their gross receipts. So far as we have been able to ascertain, no light railway undertaking in Great Britain has succumbed, or shows signs of surrender, and in the majority of cases the loss of revenue involved is serious only because the margins of profit previously realised were so small that any diminution thereof, however small, must be a matter for concern." The report proceeds to discuss the relative position, as regards capital outlay, rates and taxation of light railways and motor vehicle services, and adds—"Apart from the fact that the merits of each form of service for purposes of future development cannot be accurately assessed until it is known what obligations will be imposed upon road transport companies in respect of the making and maintenance of the ways on which they operate, the factors to be considered are numerous, and are not in every case the same. One of the most important of these factors is the volume of traffic to be dealt with, but it will not suffice to consider only the annual ton-mileage and passenger-mileage for which provision must be made. Seasonal and other fluctuations must be taken into account. . . . In determining whether a road motor service or a light railway would be better adapted to meet the requirements in any particular area, the nature, no less than the volume, of the traffic to be carried must be a determining factor."

Motor and Light Railway Passenger Services.

Making a comparison on similar lines, but in respect of a passenger service, the committee assert that there are certain other factors to consider. Motor omnibus services may be, and are being, utilised, in certain circumstances, for journeys of considerable length. For ordinary passenger services the advantages of the omnibus appeal most strongly to the short distance traveller. So long as light railways are practically debarred from using the roads, the omnibus must continue to possess a great advantage, in so far as it can pick up passengers in the streets of towns and villages and at numerous points along the route; and as the omnibus is a much smaller unit than a train, it can usually be run at more frequent intervals.

In concluding the report, the committee state—"One of the broad results of our inquiry has been to confirm our impression that a new and different conception of the character and functions of a light railway is both desirable and necessary. We are convinced that existing notions with regard to the construction and operation of light railways generally are based upon experience originally gained in the construction and working of the great main lines, and that main line traditions have governed and hampered the economic development of the small undertakings. Light railways, in our opinion, should be regarded from quite a different angle. We think that, instead of endeavouring to maintain standards of speed and service somewhat akin to those adopted by main line undertakings, it should be recognised by all concerned that light railways are in an essentially different category, and must depend for their success upon emancipation from main line conceptions of construction and operation. We are satisfied that a lower standard of speed is a first essential, and that with the adoption of such a standard the necessity for elaborate methods of construction and working would largely disappear, with the result that the economic position of the light railway industry could be radically improved, and that without any serious sacrifice of efficiency."

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EDINBURGH TRAMWAYS INQUIRY.

MINISTRY OF TRANSPORT HEARS EVIDENCE IN THE PRINCES STREET CONTROVERSY.

The intense public interest and the controversy aroused by the decision of Edinburgh Town Council to apply for powers to erect central standards in Princes Street when the tramways are electrified culminated on March 29, when the Ministry of Transport opened a public inquiry in the city. The Corporation's statutory application to the Ministry for permission to erect centre poles had been followed by strong representations in opposition. These came chiefly from the Citizens' Protection Committee, the Cockburn Association and motorists' organisations, and were based principally on the grounds of alleged danger to the public safety and of interference with the amenity of the famous thoroughfare. The inquiry was held in Parliament House, and was conducted by Sir William Marwood, K.C.B., and Colonel Pringle, of the Ministry of Transport. There was a large attendance on the first day of the proceedings, among those present being Lord Provost Hutchison, members of the Corporation, and a number of prominent people.

Mr. Graham Robertson, advocate, and Mr. T. M. Cooper, advocate, appeared for the Edinburgh Corporation, instructed by Mr. Grierson, Town Clerk; Mr. Condie Sandeman, K.C., and Mr. D. P. Blades, advocate, for the Citizens' Protection Committee, the Cockburn Association, the Automobile Association and Motor Union, the Scottish Commercial Motor Users' Association, the Scottish Automobile Club, and the Scottish Motor Trade Association, Limited; and Mr. Candlish Henderson, K.C., Mr. Skelton, and Mr. D. A. Guild represented ratepayers and frontagers in Princes Street.

Mr. R. S. Pilcher, general manager of the Corporation tramways, was the first witness. He gave the dimensions of Princes Street as—length, 1,300 yards; width, 96 feet 9 inches; and from kerb to kerb, 67 feet 3 inches. This width was uniform except at the Royal Institution, where the width from kerb to kerb was 50 feet. There were only two outlets on the south—one at the Mound and the other at the Waverley Bridge. Princes Street was practically the artery on which nearly all the tramways converged—75 per cent. of the service would have to pass through Princes Street. The car service at present on Princes Street was approximately 90 cars to the hour, each way, for 16 hours a day. With electric traction they hoped the number might increase. Dealing with the proposed erection of centre poles, Mr. Pilcher said it was intended to use the smallest of the three standard sizes of poles. It was intended to use them also for lighting, employing double brackets to carry two lights. The poles would be fixed 40 yards apart; that meant 32 poles in the length of Princes Street. There were 38 lighting poles at present. If these were removed and the lighting done by the central poles, there would be a reduction of six poles. From the traffic point of view the centre pole system as applied to Princes Street had certain advantages. The poles would regulate traffic in such a wide street so long as they did not cause an obstruction. They already had in Princes Street numerous refuges, and these made a clear line down the street. The drivers of the Corporation omnibuses saw no danger whatever in central poles—in fact, they considered that in some directions they would be an advantage, in that the poles would prevent motorists from coming from one side of the street to the other. With regard to lighting, there would be a distinct advantage, as they would have the light on both sides of the carriageway. It was also economical, as one pole would be used for a dual purpose.

Mr. Pilcher went on to say that overhead traction was a system of proved efficiency. They had about 96 per cent. of the tramway mileage of the country on the overhead system, and about 4 per cent. on the conduit. The cable system had proved itself liable to breakdowns, and he did not think it ever worked with efficiency. The citizens were determined, through the Town Council, to abolish it at the earliest possible moment. One of the greatest disadvantages of the conduit was that all kinds of miscellaneous matter from the roadway got into the slot and caused delay. This difficulty would apply equally to the electric conduit. Wherever tramway managements had gone in for different types of traction in order to avoid wires—at Wolverhampton, Blackpool, and other parts of the world—these had all been done away with. The overhead system was cheaper than the conduit system through the first cost being less and the working expenses considerably less. The central poles might cost a little more, since the rails had to be put further apart than in the case of the span wire system, but they would, on removing the rails, put down new rails, which should be taken into account in the comparison.

Mr. Pilcher explained that there was very little difference between the two systems in working costs. Central poles were preferred by the Corporation to span wires on the ground of amenity. The central poles would cost about £16,000, as against £3,000, but the Corporation were quite prepared to spend that in order to put up what they thought was a better design of equipment from the point of view of amenity. Uniformity of system was an important point. To have two forms of traction, one in Princes Street and another for the rest of the city, where cars of one system had to pass over the other, would cause more complication and extra expense. One might view with less concern a proposal for a conduit system on

The Castle. The Scott Monument.

Princes Street, Edinburgh, with present Cable Cars.

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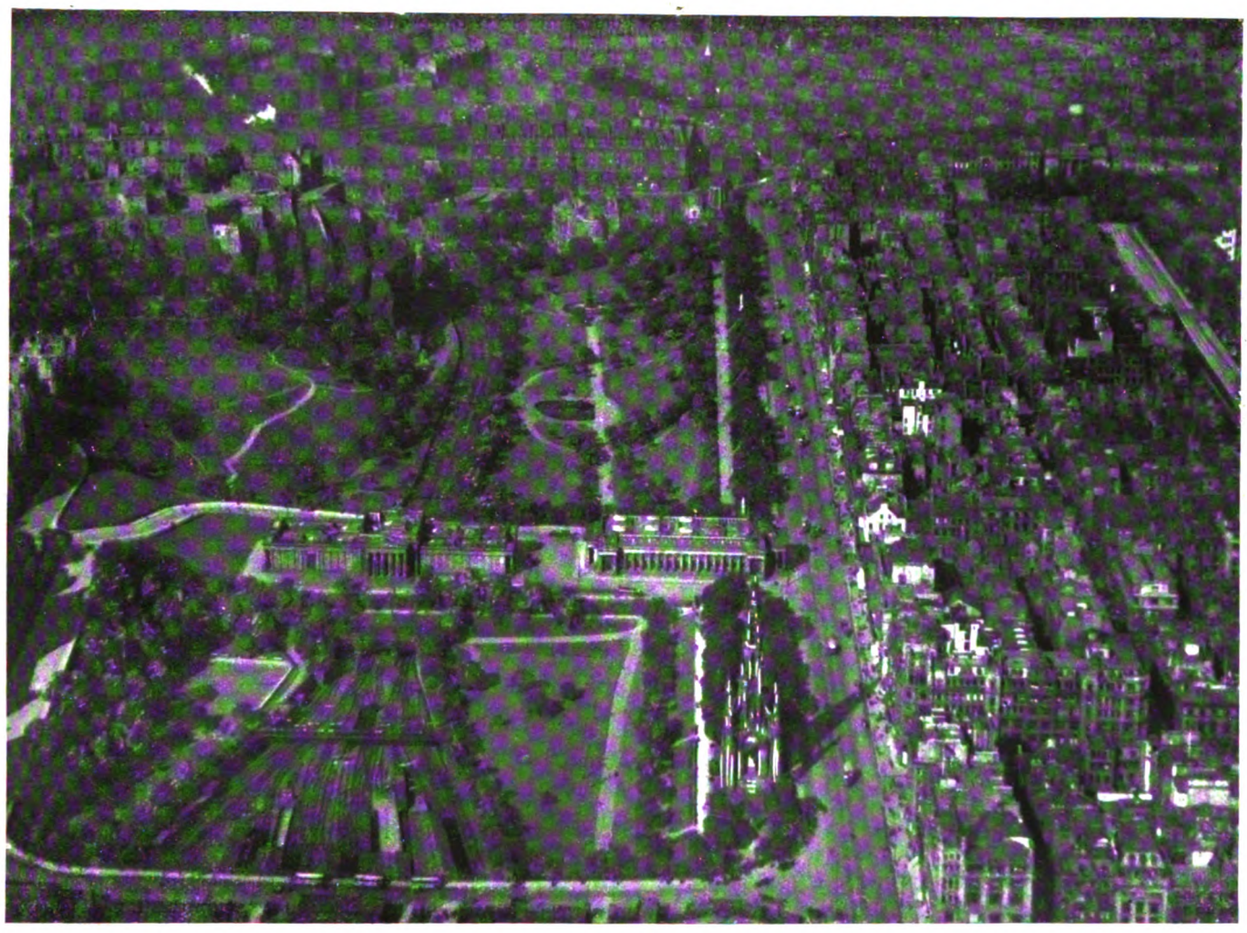
a route towards the outskirts of the city, but to suggest it for the centre of the present system was a much more serious matter. The bracket arm system could only be suitably used if the track was moved to the south side of the street, and there was there a serious difficulty with regard to the Art Gallery at the Mound. Unless the steps were removed, the lines would have to come out into the middle of the street and would cut into the line of traffic very seriously, just as they would do at the east and west ends. These objections weighed heavily with the Corporation in deciding to keep the track in the middle of the street. On the grounds of both amenity and traffic the centre pole was the best.

Mr. Pilcher mentioned that he had communicated with all the towns where centre poles had been discarded, but most of the streets in these cases were much narrower than Princes Street. Referring to a proposed alternative that cars should be entirely removed from Princes Street, and that George Street (which runs parallel) should be used, the general manager said this was not at all a convenient arrangement, and enumerated various traffic difficulties. George Street was only suitable as a supplementary route. Turning to the electric conduit system as an alternative, Mr. Pilcher said this would mean that they would have to equip all the Edinburgh cars with duplicate apparatus, and this for a very small piece of the tramway system. They would have to change from the overhead to the conduit, or *vice versa*, twice in 1,300 yards, in some cases twice in 600 yards. These change-over points all indicated a very serious interference with the uniformity and smooth working of the system. Even if the changes were made rapidly, it involved a compulsory stoppage and delay. The possibility of using the present conduit for electrification had been considered by the experts who made the report of 1916. In April 1921, he applied to the London County Council for permission to try their apparatus in Edinburgh. They sent him a model plough, rails, and insulators in order to make the experiment. The London plough would only just go into the slot. They designed a new plough, and succeeded in reducing the width to four inches, but this proved impracticable. It was his considered opinion that the cable tramways conduit would not do for electrification purposes. Mr. Pilcher alluded to inquiries he had made from the Brussels tramways and the Bournemouth Corporation Tramways, the managers of both of which systems had experience of the conduit system and condemned it. He also quoted estimates showing the cost of installing the conduit system and centre poles in Princes Street. The immediate capital cost of centre poles would be £16,851, and conduit construction £59,760. The necessary ploughs for the conduit system would cost £16,500.

Chief Constable Ross, of Edinburgh, said having regard to the exceptional width of Princes Street, he thought it was much more desirable to have centre poles than any other system, particularly because it would divide the traffic. Superintendent Arthur Bassom, traffic adviser to the Metropolitan Police, said he thought that in such a wide street as Princes Street it would make for safety if there were a defined line along the centre of the street, such as centre poles would provide.

At the resumed sitting of the inquiry on March 30, evidence was first given by Mr. Alfred Baker, general manager of Birmingham Corporation Tramways, who said that at the request of Edinburgh Corporation he had carefully considered the proposal to erect centre poles. He thought it was the only possible scheme which any tramway man knowing his business would suggest for a street having the width and importance of Princes Street. In many cases for traffic reasons centre poles had been removed. The minimum width of a road suitable for centre poles was, in his opinion, 50 feet. He could conceive of no better means of dividing the traffic than by centre poles. From the æsthetic point of view he considered that the appearance of the thoroughfare would be improved by such poles; they would give a better balanced appearance to the street as a whole. The persons who proposed to have a conduit system did not understand the difficulties of introducing a conduit in the middle of an overhead system, and there was a very serious difference in capital and working costs.



The Castle. The Scott Monument. George Street.

Princes Street and Surroundings as seen from the Air.

Mr. Sandeman, cross-examining—Do you think the view of the Castle from clubs in Princes Street would be interfered with by a line of wires? Witness—If Princes Street could be without poles altogether it would be better.

Mr. James Dalrymple, general manager of Glasgow Corporation Tramways, gave evidence as to his experience with the 200 miles

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of track in Glasgow, all of which, he said, was on the overhead system. For a road over 50 feet wide he would never suggest anything else than central poles, which he regarded as the only feasible plan for Princes Street. From the æsthetic point of view, he saw no grave objection to their introduction. He had no practical experience of the conduit system, but it was always understood to be more expensive to instal and operate than overhead, and it was not so reliable. There was nothing so reliable as the overhead electric system.

Mr. Robert Paton, the City Chamberlain, made a statement on the financial aspect of the electrification of the system. He was of opinion, based on statistics he had compiled, that the financial position of the electrified tramways would be satisfactory. "I think," he added, "that the Corporation are justified in proceeding with the conversion. The sooner they get the system electrified the better from the financial point of view, for they would begin saving." They wanted efficiency and comparatively cheap transport.

Councillor C. J. Mancor, convener of Edinburgh Tramways Committee, said if a poll could be taken of the ratepayers, they would, in his opinion, have a 9 to 1 majority in favour of the overhead system. The working class were strongly in support of centre poles for Princes Street. The Corporation had to consider economy, because they had not an unlimited purse; efficiency, after their very bitter experience; and, thirdly, amenity. The Corporation had had amenity in view in their decision to put up central poles. He could not honestly say that centre poles would affect the amenity of the street in any way.

Mr. Alexander Smith, J.P., secretary of the Edinburgh and District Trades and Labour Council, and another member of that body, urged the necessity for a cheap and reliable tramway system.

Sir Robert Maule, who said he had had considerable experience in tramway matters as a director of the Edinburgh and District Tramway Company, remarked that it was the duty of the Town Council to settle the matter. He did not think Princes Street would be disfigured by the adoption of centre poles, and he thought the Corporation would not be justified in installing the conduit electric system.

Sir John Cowan said he wanted the Corporation to adopt overhead equipment throughout the system.

CASE FOR THE OPPOSITION.

The case for the opposition to centre poles was opened by Councillor E. Graham Guest, A.M.I.Mech.E., who represented the Scottish Commercial Motor Users' Association. He said he had studied the traffic of Edinburgh streets, and had driven motor vehicles since he was 14. He could hardly believe that anyone who had a knowledge of Edinburgh traffic would put centre poles in Princes Street, which would reduce the carriageway to a minimum. The addition of poles would intensify the trouble in Princes Street. The tramway lines would be moved further apart, and that would make it impossible for two chars-a-bancs to pass on one side. If they put poles in the middle of the street they would diminish the traffic-carrying capacity of the street by one-third. He was certain centre poles would lead to accidents, and would certainly lead to the slowing down of the traffic. Islands were a necessity, but if the islands were going to be swung out the traffic would be more congested, and it would be more difficult for pedestrians to get from one pavement to the other. Councillor W. J. Thomson, director and general manager of the Scottish Motor Traction Company, stated that centre poles in Princes Street would be a positive danger from the traffic point of view.

Professor Sir Richard Lodge gave evidence on the question of amenity. He said that from his point of view wires disfigured any street. In a street like Princes Street such an eyesore became intolerable. It was the fact of spoiling and marring the beauty of what was in the main the most beautiful part of Edinburgh, the best known to all travellers and citizens, one of the three most beautiful thoroughfares in Europe, that made what was tolerated for convenience sake in humbler parts intolerable in Princes Street. If there was an alternative method to wires, even though it was costly and inconvenient, it should be adopted instead of having Princes Street spoiled. Mr. K. Findlater Campbell, C.E., said the conduit system was the only one to apply to Princes Street and its immediate approaches. It was not necessary for all the cars to have ploughs. Mr. Pilcher's estimates of cost and the number of men required to handle ploughs were too high.

Lord Johnston said he had lived in Edinburgh since 1844, and was very interested in the amenity of the place. He opposed centre poles on the ground that they would inconvenience traffic and interfere with the appearance of the town. They would also have a serious effect on the safety of those using the road. Lord Johnston repudiated the assertion that centre poles were necessary for the purpose of dividing the traffic. He said that if a vehicle driver wished to cross over from the Gardens side of the street to the shop side, thereby breaking the line of traffic on the latter side, the task would be rendered much harder if there were six centre poles between every island.

Lord Salvesen stated that he had been a member of the Cockburn Association for 20 years, and he was asked to be chairman of the Citizens' Protection Committee, which had been formed on the publication of the definite scheme now before them. He believed the people of Edinburgh were in entire ignorance of what the Corporation proposed to do until the publication of their proposals for Princes Street. It gave a shock of surprise to the vast majority of the citizens of Edinburgh that any such proposals should be made by the Town Council. Hitherto they had always trusted the Town Council to preserve the amenity of Edinburgh. Amenity was one of the assets of the city for attracting people to it, and from the commercial point of view it was desirable that amenity should be preserved. Lord Salvesen went on to speak of the volume of protests which had been raised against the centre pole scheme, and contended that the Town Council took no notice whatever. Span wires, he said, would be even more disastrous than central poles from point of view of amenity. If the conduit system were used over a total of 3½ miles in the most picturesque parts of the city, the additional annual expense would be relatively extremely small, and would have very little bearing on fares, and they should have preserved the beauty of the town.

Mr. F. C. Mears, architect, gave evidence, and presented photographs bearing on the effect of trolley wires in Princes Street. Mr. A. R. Hoare, civil engineer, Westminster, London, said he had observed the change-over from overhead to conduit on the London County Council system at Streatham, and the average time taken was 20 seconds. In regard to the comparative costs of overhead and conduit in Princes Street, witness said costs had come down enormously since Mr. Pilcher made his estimate. Professor Baily also spoke in favour of the conduit system. Councillor A. Millar said if the Ministry of Transport did not consider the question in the light of the resolution of the Town Council, they would defeat the ends of local government. Professor Wallace urged that the tracks should run along the south side of Princes Street, and leave the centre of the street for traffic.

This concluded the evidence, and after counsel for the respective sides had addressed the court of inquiry, Sir William Marwood announced that he and Colonel Pringle would make a report to the Minister of Transport, with a recommendation added.

SETTLEMENT OF NEWCASTLE TRAMWAYS STRIKE.

Employees Accept Committee's Terms.

The strike of the employees of the Corporation Tramways ended on Sunday, March 19, after having lasted three weeks, and the car service was resumed on the following day. On the previous Saturday the men held a ballot to decide whether to hold out for the 44-hour week or to accept the latest offer of the Tramways Committee. This was that the working week should be of 48 hours, and that the full terms of the National Agreement should be observed. The result of the ballot was as follows—For acceptance, 887; against, 185; majority for acceptance, 702. Although this decision indicated a strong desire to resume work, the men were in doubt as to how their action would affect the members of other unions who were also on strike. The difficulty in respect of them was referred to a meeting of their representatives and the Transport and Electricity Sub-committee. At the conclusion of this meeting a statement was issued by the committee in which they said that they had met representatives of about 240 men employed in the tramways power-station and car works, who, in common with the motormen and conductors, had been asked to work the hours recognised by their respective unions instead of the 44-hour week formerly fixed by the City Council. Notwithstanding the result of the ballot of the vehicle workers, the other unions stood out for a 44-hour week, and were not prepared to accept the result of the ballot. The committee informed the deputation that they required the whole of their employees to work the hours recognised by their unions in the same way as has been agreed by the vehicle workers. At a meeting of the tramway employees (vehicle workers) on Sunday night, the following resolution was adopted—"That we accept the ballot vote as taken on Saturday, and return to work to-morrow. In the event of any of our members being instructed to do the work of the men on strike, they shall be instructed to refuse to blackleg." Most of the employees engaged in the power-station and the car maintenance shops resumed work after being on strike for a month. The Transport and Electricity Committee advertised on March 24 for new employees, and received over 500 applications. Twenty of the men had been engaged when the committee were informed that the regular employees were prepared to resume work.

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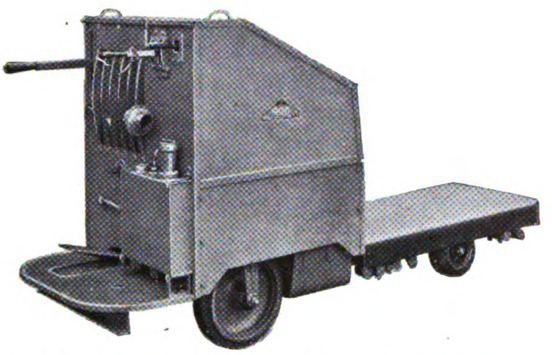
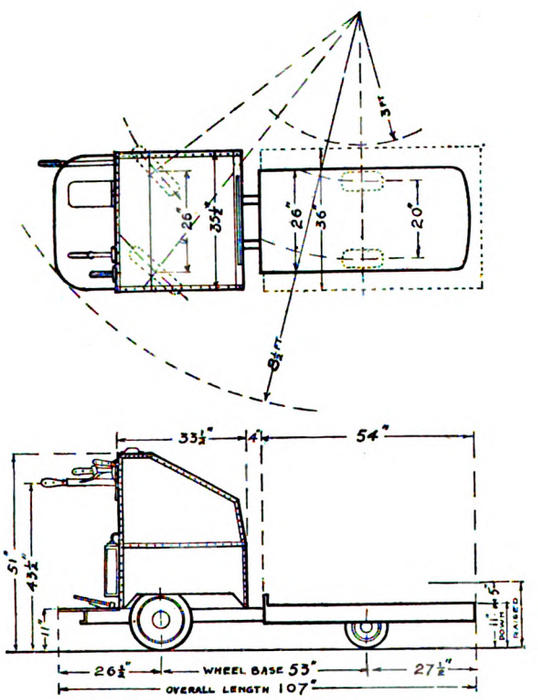
THE CLARK "TRUCLIFT" SELF-PROPELLED TRUCK.

The use of small self-propelled trucks for transport purposes in and around industrial plants has made great headway during the past few years. For work of this kind the best kind of truck is undoubtedly a self-contained unit, which will give the utmost flexibility in use, and be always ready for service. A novel truck, which fully meets the above requirements, is the Clark "Truclift," a self-contained petrol-driven machine, which is being supplied by the machinery department of Messrs. Millars' Timber and Trading Company, Limited, of Pinners' Hall, Great Winchester Street, E.C.2.



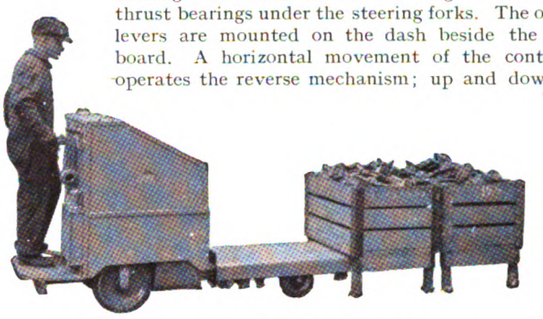
The Clark "Truclift" Self-Propelled Truck.

The "Truclift" has the added advantage that it is provided with a lifting platform, enabling the operator to load and unload the machine without dismounting, where goods are stored on suitable platforms. As the "Truclift" is under 3 ft. in width, it can operate in a narrow aisle; it will carry a load of 4,000 lb. up a grade of 11 per cent. on low gear; and it will turn round an inner radius of 3 ft.



Plan and Elevation of the "Truclift."

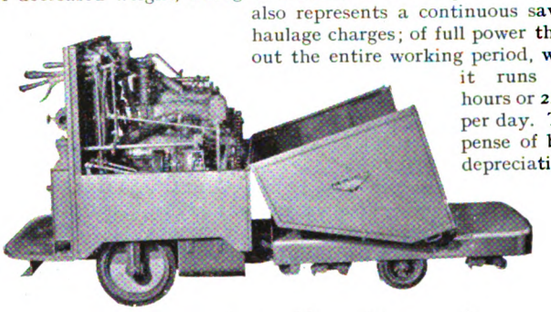
The "Truclift" is a four-wheel truck, built with a rivetted channel frame and fitted with a 4-cylinder petrol engine, with enclosed valves, high-tension magneto ignition, impulse starter, fixed spark, thermo-syphon cooling, and oil circulating pump. The engine is governor controlled, running at a speed of 1,000 revolutions per minute. It drives a two-speed gear of the planetary type, and a pressure pump (for operating the lifting platform) by means of a roller chain. From the gear the drive is through a reverse box and propeller shaft to the front or driving axle, the latter being bevel driven. The overall reduction in high gear is a trifle over 5 to 1, and in low gear 15½ to 1. The maximum speeds of the truck in either direction in high and low gear are six and two miles per hour respectively. The engine-driven pressure pump previously referred to forces light oil into a lift cylinder working under a pressure of 240 lb. per square inch, when lifting a load of 4,000 lb. on the platform. The lift cylinder has a stroke of six inches, and it operates a series of lifting levers through a rack and gear segment. This lift gear will operate the 4,000 lb. load from the minimum height of 11 in. above the floor to the maximum height of 16 ft. in eight seconds. The lift can be stopped at any point by the control lever. The truck brake is operated by a foot pedal on the running board, the brake being applied automatically when the driver removes his weight from the pedal. A carefully thought out system of lubrication is provided to all parts—high grade ball and roller bearings are used in the running mechanism and thrust bearings under the steering forks. The operating levers are mounted on the dash beside the running board. A horizontal movement of the control lever operates the reverse mechanism; up and down move-



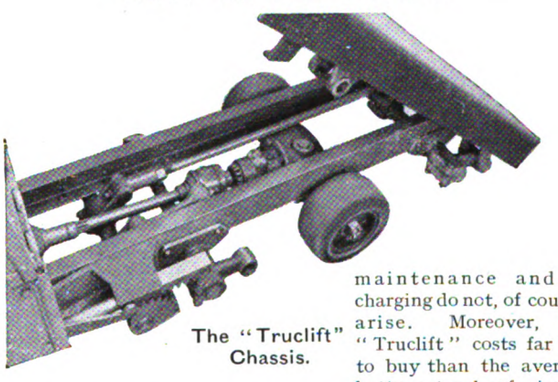
The "Truclift" Carrying a Load.

ments operate the slow and high speed gears respectively. There is a natural dragging effect present in the transmission, due to the planetary gears running over one another in the lubricant, and this provides a means of delicately manœuvring the truck, when operating the reverse, by slightly releasing the brake.

In conclusion, it may be pointed out that the "Truclift" is intended to compete with the electric battery truck, over which the makers claim that it possesses the advantage of greater mobility; of decreased weight, owing to absence of a storage battery, which also represents a continuous saving in haulage charges; of full power throughout the entire working period, whether it runs for 2 hours or 24 hours per day. The expense of battery depreciation and



"Truclift" with Motor Uncovered.



The "Truclift" Chassis.

maintenance and of charging do not, of course, arise. Moreover, the "Truclift" costs far less to buy than the average battery truck of similar capacity. The "Truclift" is a strongly built machine, constructed by the makers of the Clark "Tructractor," the well-known three-wheel dumping truck supplied by Messrs. Millars for handling contractors' materials and in use on various road construction contracts.

Removal of Centre Poles in Glasgow.—A joint meeting of Glasgow Corporation Statute Labour, Tramways, Watching and Lighting Committees have recommended the removal of the central tramway standards in Great Western Road to the side of the thoroughfare.

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FINANCIAL REPORTS AND MEETINGS.

LOSS ON THE EAST HAM TRAMWAYS.—A loss of £17,000 is reported on the East Ham Corporation Tramways for the nine months ended December 31, 1921.

LEEDS TRAMWAY ESTIMATES.—No profit is expected on Leeds Corporation Tramways, as any surplus will be absorbed in clearing off the current year's deficit.

G. D. PETERS AND COMPANY, LIMITED.—The net profit for 1921 was £5,791, and including the sum of £15,342 brought in, there is a disposable balance of £21,133. A dividend on the ordinary shares of 2½ per cent. per annum is recommended, carrying forward £12,357.

W. T. HENLEY'S TELEGRAPH WORKS COMPANY.—After providing for depreciation and debenture interest, the net profit for the past year amounts to £224,739, against £193,027 for 1920. The sum of £22,879 (against £18,432 last year) is placed to reserve, and the board recommends a balance dividend on the ordinary shares of 2s. per share, making 3s. per share, or 15 per cent., less tax, for the year, being the same as for 1920. The carry forward will be £260,243.

BRITISH ALUMINIUM COMPANY, LIMITED.—The net profits for 1921 were £83,817, and £15,314 was brought forward. A final dividend of 2½ per cent. is proposed on the ordinary shares, making 5 per cent. for the year, adding £20,000 to the depreciation reserve (making that fund £570,000) and £10,000 to the general reserve (raising it to £180,000), and carrying forward £19,534. The company's net profits for 1920 were £237,612, and the ordinary shares received 10 per cent.

THE BRUSH ELECTRICAL ENGINEERING COMPANY'S report for the year ended December 31, 1921, shows a substantial improvement in earnings. The gross profit amounted to £232,600, as against £191,100. A dividend on the ordinary shares is recommended at 15 per cent. The depreciation allowance is raised from £13,000 to £15,000, and £73,200, as compared with £43,400, is transferred to the general reserve, bringing the total to £150,000. Subject to taxation, the carry over is £214,074, or £70,800 more than a year ago.

STEWARTS AND LLOYDS, LIMITED.—After providing for income-tax and corporation tax, the board recommend a dividend on the fully-paid deferred shares Nos. 1 to 850,000 and Nos. 1,700,001 to 2,630,030, inclusive of 10 per cent. and a bonus of 2½ per cent., together 12½ per cent., tax free, for the year 1921. The deferred shares (fully paid from September 30, 1921), Nos. 850,001 to 1,700,000 inclusive, will receive a dividend to December 31, 1921, of 7½ per cent., and a bonus of 1⅞ per cent., both tax free. The sum of £70,000 is again set aside for depreciation, while £230,000 is placed to reserves, against £150,000 last year, £10,000 (same as a year ago) to employees' benefit reserve, and £180,000 carried forward, against £110,000 brought in.

ARGENTINE TRAMWAYS AND POWER COMPANY, LIMITED.—The report for the year to September 30, 1921, states that net receipts from operation totalled £28,028, an increase of £5,442, and total revenue £28,559, against £26,893. A scheme of arrangement approved by holders of preference and ordinary shares on March 22 provides, *inter alia*, that £18,323 standing to the credit of the revenue account at September 30, 1920, shall be carried to reserve, and shall not be treated as profit available for dividend. Subject to the scheme being approved by the court, and to £50,000 of 5 per cent. debenture stock, subscriptions for which have been conditionally promised, being allotted, the directors propose dividend at the rate of 5 per cent. (less tax) on preference shares in respect of past year, carrying forward the balance.

BRUCE, PEEBLES AND COMPANY, LIMITED.—The annual report shows that the profit for the year amounted to £113,793, and including £5,823 brought forward, there is a balance of £119,616. This sum has been appropriated as follows—To taxation reserve account, £40,000; depreciation reserve account, £10,000; general reserve account, £32,221. A full dividend for the year on the preference shares of 10 per cent., less income-tax, and a dividend on the ordinary shares of 10 per cent., with a bonus of 5 per cent. (both less tax, payable on March 31) require £29,476, leaving a balance of £7,919 to be carried forward. The output from the works was the largest in the history of the company, and the directors regard the results as satisfactory. The prospects for the current year are said to be good. The reserve account now stands at £100,000.

BRISTOL TRAMWAYS AND CARRIAGE COMPANY.—Progress in revenue is again shown in the report for the year ended December 31, 1921, while working expenses were somewhat lower. Revenue was £1,022,208, and working and general expenses and renewals £951,589, leaving with balance brought forward, together with an amount recovered on an adjustment of income-tax, a net revenue of £104,100. It is proposed to pay a final dividend on ordinary shares of 4 per cent., free of tax, making 7 per cent. for year, carrying forward £3,668. After charging expenses of issue of new ordinary shares and adjusting value of investments at December 31 last, the reserve fund amounts to £339,557. Receipts of tramways department show increase of £112,186, and carriage department decrease of £7,996. Number of passengers carried was 72,301,531, decrease of 12,681,903. At the annual meeting held on April 6, Mr. Samuel White (the chairman), who presided, said they had had a very hard year's work, and the results of it, on the whole, were more satisfactory than might have been the case. He intimated that the company contemplated foregoing the 2d. minimum fare, and re-introducing the 1½d. minimum.

CAMMELL, LAIRD AND COMPANY, LIMITED.—The annual meeting was held at Sheffield on April 6, Mr. W. L. Hichens (the chairman) presiding. Mr. Hichens said the industries of this country had every reason to feel confident that they would win back the commercial supremacy of the world. He thought they were justified in claiming that the Government and local authorities should follow suit in the economies that were being practised elsewhere. While they, as a firm, had not so much work on hand as a year ago, yet he believed they could hold their own in the future against any of their competitors. He thought it unlikely that an improvement in trade would come early enough to make the present year a good one, but the clouds would break some day and the sun would shine. The assets of the company had been well written down, and they were in a position to render a very good account of themselves as soon as the present depression was over. Never had there been such a complete and sudden transition from high prices and booming trade to utter stagnation and collapse. The real key to the whole problem was that we had got to get prices and costs down to the lowest possible level before there could be industrial prosperity. In some lines, possibly, prices had already come down as low as was practicable, but in others they had not, and it was essential there should be a uniform reduction. A dividend is recommended on the ordinary shares of 5 per cent. for the year ended December 30 last, carrying forward £38,637. The additional capital created in 1920 now receives a dividend for the first time. In 1920 the dividend was at the rate of 7½ per cent., and the balance carried forward was £71,471.

METROPOLITAN-VICKERS ELECTRICAL COMPANY.—The annual meeting of the Metropolitan-Vickers Electrical Company, Limited, was held in London on April 5, Mr. J. Annan Bryce (the chairman) presiding. Mr. Bryce said the profit available for the year was £440,342, or nearly £40,000 in excess of that of 1920. This was satisfactory in view of the depression in trade during the year. Orders received were considerably fewer than in the preceding year, but the shops were kept fully employed, owing to the number of orders remaining unexecuted at the beginning of the period. As a result of the year's operations, they were enabled, after allocating £35,000 to special depreciation, and raising the general reserve to £400,000, to increase the carry forward by £33,991. Alluding to orders received recently by the firm, the chairman said that for these there had been keen competition, the object being to keep the works as fully employed as possible. One large order, running into about a million pounds, for the supply of electrical railway equipment to the South African Government, they had been fortunate enough to secure during the current year in face of severe competition from both America and the Continent. The traction department, of which Mr. P. S. Turner was the head, was to be congratulated on the work that it did in obtaining this order. In their own particular industry a renewal of activity was expected in connection with the schemes for co-ordination of power supply and electrification of railways, in the orders for which this company, with technical equipment second to none, was entitled to hope for a fair share. After referring to the engineering trade dispute, and to the continuance of "the most cordial harmony" within their own works between the management and employees, Mr. Bryce said the output of the year had been the largest during the history of the company, exceeding by 35 per cent. the output of 1916. He alluded to the loss the company had suffered by the death of Sir Francis Barker, and said it had been decided to invite Mr. Douglas Vickers, head of the great organisation which bore his name, to take the vacant place on the board. The directors recommended the payment of a dividend on the ordinary shares of 12½ per cent., less income-tax, for the year ended December 31 last.

HADFIELDS, LIMITED.—The accounts for 1921 show a profit of £158,157, and a balance dividend of 2½ per cent. is recommended on the ordinary shares, making 5 per cent. for the year, tax free, being the same as for the previous year. The "carry forward" is reduced from £135,727 to £122,657. It is stated that adjustments may be necessary to meet the provisions of the Munitions and Finance Acts. The coal miners' dispute greatly affected the working of the company. The directors state that owing to the considerable volume of orders in hand at the beginning of the year under review the effects of the general depression in the engineering industry were not acutely felt until the latter part of the year. In pursuance of an agreement designed to promote community of interests, the company invested

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£25,000 in the Vulcan Foundery, of Newton-le-Willows, Lancashire, one of its oldest customers, and the Vulcan Foundry have invested a like sum in Hadfields. There are now signs of an improved demand for the American company's products, and that the expectations which were formed by the directors in developing this new field will mature. As part of the scheme of arrangement sanctioned by the Court in the affairs of A. Harper, Sons and Bean, the directors of Hadfields have arranged for the exchange of the greater part of the latter company's holding in Harper Bean for a holding in A. Harper, Sons and Bean, the manufacturing company, and the chief consumers of Hadfields' material. Towards the scheme of reconstruction Hadfields has undertaken to subscribe £50,000 of the first debenture required for additional working capital, and will be represented upon the new board. Hadfields' new steel foundry which forms an important part of the adaptation of the company's war extensions to peace purposes, is now completed, and has for some months been working successfully. It will, it is stated, undoubtedly provide a profitable addition to the company's resources when the general conditions of trade improve. The two smaller rolling mills are also now working successfully, and the large cogging and billeting mill is approaching completion, and will be available for useful service so soon as the opportunity arrives through a revival in trade.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.

TRACK RECONSTRUCTION.

At a meeting of the City Tramways Committee the general manager (Mr. J. S. D. Moffet) submitted a report on two alternative proposals for permanent way reconstruction in 1922. These were—(1) For proceeding with the second instalment as outlined in the principal report of last year; and (2) for a modified instalment dealing with the sections most in need of repair. It was decided to advertise for alternative tenders.

BIRMINGHAM.

MOTORMAN'S COMPENSATION.

A former Corporation tramcar driver, aged 64, applied at the County Court under the Workmen's Compensation Act for the restoration of a weekly payment. Counsel for the applicant said in November 1915, he was seriously injured in a tramway accident, and was treated by a doctor until July 1916. Up to June 19, 1916, he was paid 19s. a week compensation. Payment ceased upon an agreement for a declaration of liability being recorded. The applicant resumed work under the Corporation until January 15, 1922, when he reported sick. The applicant's case was that at present, in consequence of the accident, he was incapacitated from work, and medical evidence was called. The respondents denied liability on the ground that any incapacity was not due to the accident. The Judge awarded compensation of 20s. a week, with the usual war additions.

CARDIFF.

CORPORATION AND THE TRAMWAYS COMPANY.

The City Council have given plenary powers to a sub-committee of the Tramways Committee to deal with the proposed purchase of the undertaking of the Cardiff Tramways Company. Councillor Sydney Jenkins (chairman of the Tramways Committee) said it would facilitate matters if this were granted, as there was a tremendous difference between the sum required for the undertaking and the amount the committee were prepared to pay.

CHESTER.

RECONSTRUCTION OF THE TRAMWAYS.

The Tramways Committee have again considered the report on the undertaking prepared by Mr. A. R. Fearnley (general manager of Sheffield Corporation Tramways), which was summarised in our issue of December 17, 1921. They also received reports from the City Surveyor and the Acting City Accountant. The committee decided to recommend the Council (1) that the tramways be maintained as at present laid out for a further period of seven to eight years, at the end of which period the full life of the track will have been obtained; (2) that the recommendation set out in Mr. Fearnley's report be carried out, and that the City Surveyor be authorised to proceed with the work at a cost of £12,000, and report to the committee as to progress from time to time, and that he be empowered to obtain the workmen, plant and materials necessary for the work; (3) that the cost of the work be defrayed out of the reserve fund of the tramways undertaking.

DONCASTER.

SANCTION FOR TRAMWAY IMPROVEMENTS.

The Ministry of Transport intend to make an order conferring upon the Corporation powers to extend and improve the tramway system by the construction of a loop through Trafford Street and Factory Lane, and by alterations in Baxter Gate and St. Sepulchre Gate, in accordance with the scheme outlined in the Corporation's recent application. The scheme will abolish the present Frenchgate terminus for the Brodsworth and Bentley cars.

HULL.

TRAMWAY PROFITS RELIEVE RATES.

The City Council has adopted the recommendation of the Finance Committee that £10,000 of the tramway profits should be allocated to the relief of the rates.

KEIGHLEY.

INCREASED FARES.

The minimum fare on the Corporation Tramways was increased from 1d. to 1½d. on April 1. The Town Council have declined to sanction a proposal to borrow £40,000 for track reconstruction.

LEICESTER.

TRAMWAYS EXTENSION.

The City Tramways Committee have decided to proceed immediately with the installation of the electrical equipment on the Welford Road route, and open the section for traffic at the earliest possible date. They point out that on May 26, 1914, the Council decided to construct the section. After the completion of the track and certain overhead equipment the works had necessarily to be suspended in consequence of the war.

LIVERPOOL.

FARES INQUIRY.

The Corporation made an application to the Tramway Charges Advisory Committee at the Ministry of Transport on March 14, to be allowed, under the Acts of 1918 and 1920, to continue until February 15, 1923, charges not exceeding those at present operative on the undertaking in the city of Liverpool, the borough of Bootle, and the urban district of Litherland, and in respect of the tramway or light railway between Liverpool and Prescot. Mr. F. W. Pierce, Deputy Town Clerk of Liverpool, accompanied by Messrs. Frank Wilson (chairman of the Tramways and Electricity Committee), P. Priestly (tramways manager), and R. Barrow (City Treasurer) were present on behalf of the Corporation. Bootle Borough Council opposed the application, and Litherland forwarded a letter saying that the increased fares were a great hardship, and pleading for the restoration of the penny ticket. Mr. Pierce said notwithstanding certain increased fares in 1920, the expenses were £1,490,625 and the revenue £1,457,549, leaving a deficit of £33,076, and in addition the whole of the reserve fund had been exhausted. The fares were increased by statute in 1921. The deficiency in that year was not so great as was expected. Expenses were £1,607,542, revenue £1,558,906, and the deficiency £48,636. Mr. Priestly said the expenses of the system had risen 239 per cent. since 1913, but fares had only increased 38 per cent. Mr. Wilson said a return to the old fares would mean a loss of £300,000 a year. Mr. Tumilty said Bootle, with its labouring population, wanted a return to the penny fare for short stages. (The present minimum fare in Liverpool is 2d.)

LONDON.

THROUGH SERVICES AND BOOKINGS.

With the completion of the work of lowering the roadway under the railway bridges at Clapham and Balham stations, the London County Council tramway authorities on March 24 commenced running the new class E/1 cars on the Clapham, Balham and Tooting route. These cars have the overhead trolley arm as well as the underground connection, and when the work of joining up the track at Merton with the London United Tramways is completed, it will be possible to run a through service from Victoria Embankment to Wimbledon Station.

At the meeting of the County Council on March 28 the receipt was reported of a communication from the London General Omnibus Company intimating that owing to the poor receipts on the service of omnibuses from Charing Cross (Embankment) to Cricklewood the service would be discontinued as from March 22. This withdrawal of the service involved the discontinuance of through bookings between points on the Council's tramways and Piccadilly and Oxford Circus, as there is no other direct service to these points from the Embankment. The Highways Committee recommended that an agreement be made with the Metropolitan Electric Tramways, Limited, for the withdrawal of all short running cars turning at Finsbury Park, and the substitution of through services; for the payment by the company to the Council of 10·5d. a car-mile in respect of the car mileage run by the Council in excess of its proportion under existing through running arrangements; that the arrangement remain in force for six months, and be terminable on September 29, 1922, on one month's notice on either side, or thereafter on three months' notice on either side.

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CONTRACTS AND ORDERS.

The British Thomson-Houston Company's tender for main E.H.T. switchboard extension has been accepted by Warrington Corporation.

The Pirelli General Cable Works, Limited, are supplying 4-core cable to Birkenhead Corporation. The amount of the contract is £1,007 15s.

Bradford Tramways Committee have accepted the tender of the Kirkstall Forge Company for the supply of 14 steel axles required for trolley vehicles, at the total price of £1,182 14s.

The Woods Gilbert Rail Remodelling Company, of 170 Strand, London, W.C., are now carrying out the repair of Exeter Corporation tramway track by means of electric arc welding and rail grinding.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C.2, have been appointed sole advertising contractors for Ipswich Corporation Tramways and Birkenhead Corporation Ferries.

Wallasey Corporation have accepted the tenders of United Water Softeners, Limited, for water-treating plant for the electricity department, £1,368; and Metropolitan-Vickers Electrical Company for switchgear, £2,600 10s.

Clough, Smith and Company, Limited, of 36 Victoria Street, London, S.W.1, have arranged a contract with the Eston Urban District Council for the supply and erection of the overhead equipment, comprising 700 poles, etc., and the supply and laying of about 4½ miles of underground mains in connection with the town lighting of South Bank, Grangetown, Normanby, and Teesville.

Metropolitan-Vickers' New Zealand Order.—A Reuter message from Wellington, New Zealand, states that the Government have accepted the tender of the Metropolitan-Vickers Electrical Company, of Manchester, amounting to £30,704, for the supply of switch gear for the Mangahao hydro-electric installation, which will provide the Wellington district and city with electrical power. The installation will have the highest electrical pressure in Australasia and the best and most reliable controls were necessary. The lowest tender received was one for £24,666 from America.

Short Brothers (Rochester and Bedford), Limited, of 20-30 Charing Cross, London, S.W.1, have secured a further contract from the London General Omnibus Company for 250 of their "S" type omnibus bodies. Deliveries on this contract alone will total 20 complete bodies mounted on chassis per week. The new order will bring the total number of bodies built for the London General Omnibus Company to nearly 600. Messrs. Short Brothers have in hand also other large orders for Railless, Limited, the East Kent Road Car Company, Salsom Cars, Limited, etc. All these orders necessitate quick deliveries at competitive prices.

Electrification in Holland.—The Zeeuwsch Vlaamsche Tramweg Company, of Axel, Zeeland, according to the Dutch newspaper *Handelsbelangen*, propose laying a tramway, with power-station, depots, etc., in Zeeland. It is intended to make a start on the work at the end of this year, and the plans will probably be drawn up by W. E. Kramer and H. Polano, engineers, 18a Noordeinde, The Hague. The same paper reports that the granting of a concession for the electrification and extension of the Gooische Stoomtram may be expected this year. The line from Amsterdam to Hilversum will be the first to be electrified, and a power-station and annexe buildings will be constructed in connection with the scheme. The director of the company is F. M. Augustijn, of Watergraafsmeer.

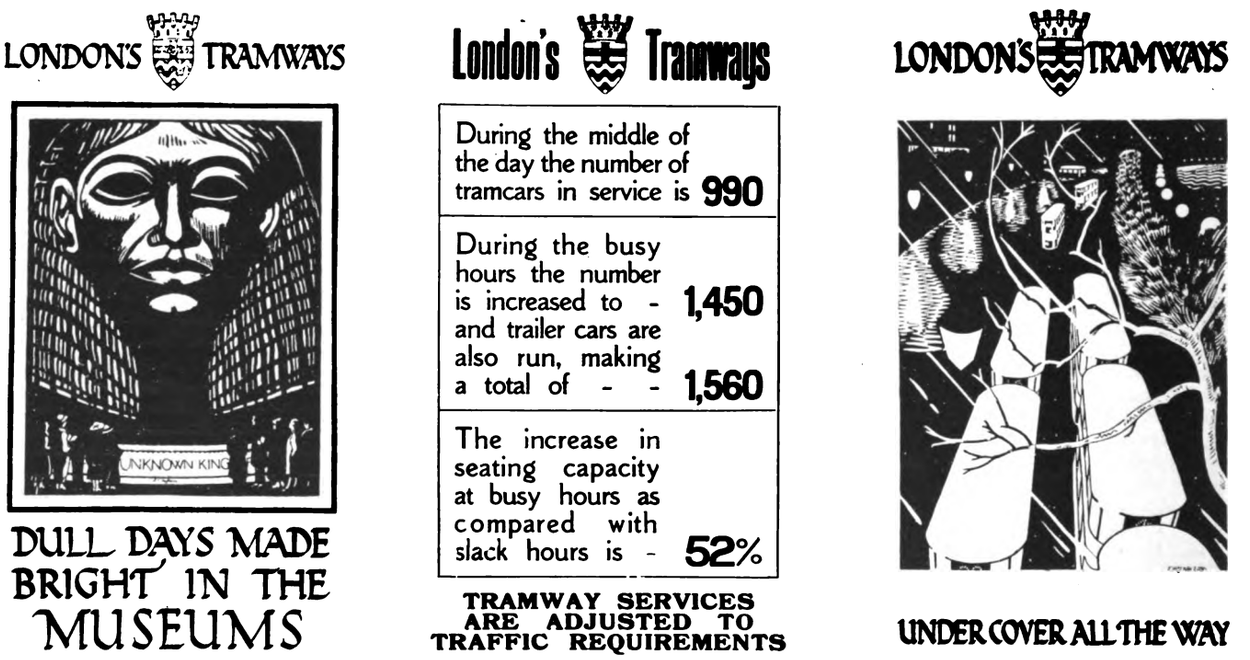
The Edinburgh Corporation Tramways Committee have recommended acceptance of the quotation of a German manufacturer in Cologne for 130 tons of tramway rails and five tons of fishplates. The German firm quoted, through their British agent, £1,365, and the nearest British offer was £1,495. Bailie Sleigh and Councillor Couston opposed acceptance of the foreign quotation. The committee also unanimously recommended the tender of another German firm for steel poles. The British quotation was £7,977, as against £5,436 by a Dusseldorf firm. The Town Council, however, declined to confirm the Tramways Committee's proposals and decided to allocate the contracts as follows: for the supply of rails and fishplates, Dorman, Long and Company, Middlesbrough; for the supply of steel poles, Stewart and Lloyds, Limited, Glasgow.

INTERNATIONAL RAILWAY CONGRESS.

The International Railway Congress will be held at Rome from Tuesday, April 18, to Friday, April 28, in the Palais de l'Exposition Nationale. M. Tondolier, of the Belgian State Railways, will preside. The Ministry of Transport will be represented by Col. J. W. Pringle, chief inspector of railways, and Sir W. M. Acworth. There will be an official reception at the capital, and the delegates will on Wednesday, April 19, be the guests of the Italian Government at dinner. Among the subjects to be discussed is that of railway electrification.

BRITISH TRAMWAYS IN MONTE VIDEO.

Despite formal protest by the British Foreign Office, the municipality of Monte Video, Uruguay, continues forcibly to control the funds of the British tramway company in that city, it is reported. The municipality has extracted a further sum from the company's coffers to pay the increase in wages in respect of the first fortnight in March. The extraordinary situation disclosed originated in the refusal of the Uruguay Government, at the instance of the Socialist group in the Chambers, to grant permission to the tramway company to raise its tariff. The company being therefore unable to grant the men increased wages, a strike ensued, whereupon the municipality ordered the men back to work and itself seized control of the company's property and paid the increase out of the company's funds. The company is taking legal action against the municipality.



SOME RECENT POSTERS ISSUED BY THE L.C.C. TRAMWAYS.

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PERSONAL.

Mr. Charles W. Matthews has been appointed chairman of the Highways Committee of the London County Council.

Mr. John Craig has been elected president of the National Federation of Iron and Steel Manufacturers for the ensuing year.

Mr. J. A. Forde, engineer and general manager of the Isle of Thanet Electric Tramways and Lighting Company, Limited, has been appointed a Justice of the Peace.

Mr. Arthur Ellis has been asked by the Hull Corporation Electricity Committee to report on their electric supply undertaking from the technical and commercial point of view.

Mr. W. J. Gray, late of the Goodyear Tyre and Rubber Company, Limited, has now joined Messrs. Leo. Swain and Company, Limited, as tyre department representative for the Fylde and East Lancashire districts.

Mr. C. P. Sandberg, C.B.E., has been appointed by the Ministry of Communications of the Chinese Government, Pekin, as technical delegate at the International Railway Congress, which opens at Rome on April 18.

Mr. A. H. Martin, who was with the Bristol Tramways and Carriage Company, Limited, in various capacities for over 16 years, and latterly has been traffic superintendent of the Northern General Transport Company, has been appointed to the position of outside manager for the Crosvile Motor Company, Limited, Chester.

Mr. G. H. Hume has been elected alderman of the London County Council. As formerly for several years chairman of the Highways Committee, Mr. Hume's services to the London County Council Tramways are well known, and his election as alderman is a well-merited recognition of the valuable work which he has done on this and other important committees.

Councillor T. Canby, deputy chairman of the Huddersfield Corporation Tramways Committee, has been appointed chairman of the committee in succession to the late Alderman E. H. Sellers. Councillor Canby became a member of the Tramways Committee in 1911, and in 1915 was appointed deputy chairman. **Councillor T. Woffenden** has been elected deputy chairman.

Birmingham Corporation Tramway Officials.—The principal officials of the Birmingham Corporation Tramways, in addition to Mr. A. Baker, the general manager, are now as follows—Assistant general manager, Mr. J. McDonnell; chief engineer, Mr. A. C. Baker; electrical engineer, Mr. T. Rowland; permanent way engineer, Mr. G. Warner; traffic superintendent, Mr. L. Johnson. Councillor Frederick Smith is chairman of the Tramways Committee.

Mr. Harry A. Blackburn, M.I.E.E., has been appointed rolling stock superintendent of the Plymouth Corporation Tramways, and took over his duties on April 3. Since he was demobilised Mr. Blackburn has been attached to the staff of the Metropolitan-Vickers Electrical Company, Limited, Trafford Park, Manchester. He is the only son of Mr. A. A. Blackburn, M.I.E.E., M.I.Mech.E., general manager and engineer of the Huddersfield Corporation Tramways, and formerly chief engineer of the Belfast City Tramways.

Mr. Ernest Hatton.—Newcastle City Council on March 29 received a letter from Mr. Ernest Hatton (general manager and engineer of the tramways) referring to his resignation, tendered in a letter dated February 7. Mr. Hatton said he had received further medical advice, and had been given a more favourable report. After the short rest he was feeling somewhat better, and he therefore desired to be allowed to withdraw his resignation. On the motion of Alderman Sir Johnstone Wallace, Mr. Hatton's letter was referred to the Tramways Committee, who unanimously accepted the withdrawal of the resignation.

Mr. John C. Mitchell, F.C.I.S., who has been appointed a Justice of the Peace, joined the old London Road Car Company in his early youth, and ultimately was appointed secretary in 1905. On the amalgamation of the London omnibus companies in 1908 he was appointed secretary of the London General Omnibus Company. Later he became treasurer of the Underground Electric Railways Company of London, and its associated companies. He is a Fellow of the Chartered Institute of Secretaries, and has been president of the Institute. In 1912 he became a member of the Lambeth Borough Council, and for some years has represented that Council on the Metropolitan Water Board. During the war Mr. Mitchell was largely instrumental in organising local volunteers, and he has been president of the Norwood and Streatham Rifle Club. He is vice-president of the London Association for the Blind, and governor of the Belgrave Hospital.

Mr. Charles W. Matthews, the newly-elected chairman of the Highways Committee of the London County Council, although elected to the Council only three years ago for South-west St. Pancras, has had much experience of municipal work in that borough. He has been associated with the Borough Council for 20 years, is an alderman, and has held office as mayor. He has served as chairman of the local Building Committee, and for many years represented the Borough Council on the Metropolitan Water Board. Mr. Matthews has also given his assistance in several other forms of municipal activity. In conversation with a representative of THE TRAMWAY AND RAILWAY WORLD, Mr. Matthews, while declining to express any opinion on London tramway matters (which, of course, come under the purview of the Highways Committee), said he should endeavour to provide the public with the best possible service compatible with economic working. He believed that the transport facilities of London need to be greatly improved, and he is hopeful of seeing this accomplished in the near future. This will come, he thought, with the revival of trade and easier money.

L.C.C. TRAMWAYS—NEW COMMITTEES.

At the meeting of the County Council on March 21 the following were appointed members of the Highways Committee—

Charles W. Matthews (*Chairman*)	E. H. Kemp	Capt. G. E. Pierrepont
D. Davies	Lt.-Col. A. C. H. Kennard (*Vice-chairman*)	F. W. Raffety
F. Bertram Galer	Samuel March	Angus N. Scott
T. C. E. Goff	W. J. Morton	W. J. Webb
The Earl of Haddo	John Osborn	Capt. O. Wakeman
G. H. Hume	Miss Rachel M. Parsons	Henry Ward

The Stores and Contracts Committee will consist of the following 13 members—

Lt.-Col. Eric Ball	D. Davies	W. J. Pincombe
Sir John Benn, Bart.	Frank Holmes	Sir Lulham Pound, Bart.
J. G. Butler	William Hunt	Percival H. Reed
David Cawdron	W. C. Johnson	Major Isidore Salmon
Edward Cruse		

The London Electricity Supply Committee will consist of the following 14 members—

Ernest M. Dence	The Lord Monk-Bretton	Major Isidore Salmon
Percy A. Harris	Herbert Morrison	Ernest Sanger
G. H. Hume	O. W. Nicholson	Henry Ward
Sir Cyril Jackson	R. C. Norman	W. J. Webb
Henry Mills	Miss Rachel M. Parsons	

The Committee of Selection reported that they did not propose that the Special Committee of Inquiry on Tramways should be re-appointed.

BUSINESS NOTICES.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, have removed their London offices from 83 Cannon Street, to Crown House, Aldwych, W.C.2. Telephone, Regent 8040.

THE DAIMLER COMPANY, LIMITED, have notified the members of the Motor Trade Association that they have altered the price of their 2-3 ton commercial vehicle chassis from £750 to £700. The change is made on all vehicles sold from March 20 until further notice.

TRACKLESS CARS.—A new company was registered on February 21, with a nominal capital of £10,000. The company adopts an agreement with G. A. Bishop and R. A. Chadwick, and will manufacture and deal with electric trackless and railless cars. The address is Hepworth Chambers, 148 Briggate, Leeds.

THE PREMIER ELECTRIC WELDING COMPANY, LIMITED, with the object of increasing the efficiency of its organisation, proposes to concentrate a number of its departments in the London area. Arrangements are being made to transfer the head office, technical and research laboratories and electrode factory to Abbey Wood. All communications should now be addressed to the Premier Electric Welding Company, Limited, Abbey Wood, London, S.E.2.

HOLLINGS AND GUEST'S horizontal 4-throw chain-driven pump has been selected by the Baroda State Railways for working hydraulic presses in the Baroda workshops. Messrs. Hollings and Guest are also supplying a large hydraulic accumulator to work in conjunction with this plant. They are also supplying a hydraulic briquetting press to the East Indian Railways. We are informed that many other British and foreign railway companies have installed presses of Hollings and Guest's manufacture for various purposes, such as solid tyre fitting, wheel forcing, scrap metal bundling, forging, etc. The manufacturers are producing this class of machinery on a large scale.

BERNA LORRIES.—La Fabrique d'Automobiles Berna S.A., of Olten, Switzerland, have announced that by assignment dated December 31, 1921, they have acquired from British Berna Motor Lorries, Limited, and from Berna Lorries, Limited, all rights of manufacture and sale throughout the entire world, and that La Fabrique d'Automobiles Berna S.A. are now alone in a position to manufacture, sell and deal in "Berna" products. Spare part stocks have been replenished, and almost any order can be executed on receipt. The temporary premises of the London depot are situated at 25 Short Street, New Cut, S.E.1. The Swiss Company will appoint agencies all over the country, and a good business opening is available for firms specialising in commercial vehicles of high-class quality.

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PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Seats of tramcars, etc. (7,224)—N. J. Ashton.
Change-speed mechanism for motor vehicles (7,235)—C. G. Atha.
Hub brakes for motor vehicles (6,738)—W. G. Bryan.
Current collecting apparatus for electric tramways (7,105, 7,106, and 7,107)—A. A. Bull and C. W. Kay.
Steering gear for mechanically propelled vehicles (7,169)—H. W. Egerton and Marles Steering Company, Limited.
Electric contact makers for steering wheels of motor vehicles (6,713) —Eurul Patents, Limited, and H. J. Waller.
Tyres for motor vehicles (6,927)—J. V. Eurich.
Variable gears for motor vehicles (6,638)—J. C. Harris.
Electrically propelled vehicles (6,821)—L. B. Hewitt and Metropolitan Electric Tramways, Limited.
Lifting jacks (6,686)—W. Heyden.
Motor vehicles (7,030)—W. E. M. Woan.
Driving gear for motor vehicles (7,529)—L. Anderton.
Electrically propelled motor vehicles (7,814)—C. J. Gordon.
Life guard for motor vehicles (7,305)—H. H. Hancock.
Motor vehicles (7,928)—H. Hudson.
Driving gear of motor vehicles (7,628)—O. Y. Imray (*International Motor Company*).
Steering gear for motor vehicles (7,757) —A. H. Leah and H. Mobbs.
Collapsible covers for lorries, chars-a-bancs, etc. (7,636)—F. T. Murdoch.
Life guards and brakes for motor vehicles (7,575)—J. G. Navarro.
Brake adjusting mechanism for motor vehicle wheels (8,631)—Aéroplanes H. and M. Farman.
Method of jointing rails (8,514)—J. Armstrong and J. H. C. Brooking.
Variable speed gearing (8,156)—E. Austin.
Wheels for motor vehicles (8,024)—F. W. Baker.
Control of electrically propelled vehicles (8,247)—British Thomson-Houston Company, Limited, and H. C. Hastings.
System for operating permanent way points (8,564)—J. W. Christison.
Power propulsion of road vehicles (8,012)—W. H. Dunkley.
Rims of wheels for motor vehicles (8,131)—Dunlop Rubber Company, Limited, and W. H. Paull.
Solid rubber motor vehicle tyres (8,145)—H. W. Ingram.
Automatic life-saving fenders for automobiles (8,084)—E. S. Jones.
Motor vehicle brakes (8,234)—Lanchester Motor Company, Limited, and G. H. Lanchester.
Turnstiles for registering and checking passengers (8,573)—London Electric Railway Company and J. P. Thomas.
Rail joint chairs (8,430)—J. J. Markovich.
Front wheel brakes for motor vehicles (7,996)—G. E. Raybould and G. Whitford.
Electric signalling systems for railways (8,710)—Westinghouse Brake and Saxby Signal Company, Limited (*Union Switch and Signal Company*).
Traction devices (8,931)—A. E. White (*Athey Tractor Company*).
Combination clutch and variable gear for motor vehicles (9,172)—F. E. Baron.
Rail dressing machines (9,140)—T. Brooks and the Woods-Gilbert Rail Remodelling Company, Limited.
Means for controlling water circulation in internal combustion engines of motor vehicles (9,096)—G. Campbell and K. S. Molyneux-ffennell.

SPECIFICATIONS PUBLISHED

1920

Adjusting mechanisms for brake rods of tramway vehicles (22,757—*149,678*)—A. Chaumont).
Tramway sleepers (28,451—*174,989*)—R. Baker.
Apparatus for operating the points of tramways (31,477—*175,048*)—H. A. Thomson.
Tramway vehicles (17,389—*175,302*)—P. Kavanagh.
Pit tubs tramway vehicles (28,631—*175,337*)—G. Milnes and E. R. Milnes.
Brakes for motor road vehicles (32,194—*175,400*)—D. Napier and Son, Limited, and A. J. Rowledge.
Brakes for motor road vehicles (34,000—*175,458*)—W. H. Scott and R. H. Davis.
Motor road omnibuses (29,271—*175,684*)—R. S. Pilcher.
Ticket or fare boxes having fare registering means connected therewith (29,409—*175,685*)—Johnson Fare Box Company and A. J. Tanner.
Automatic couplings for tramway vehicles (34,254—*175,799*)—A. L. McColl.
Automatic locking devices for manually operated brakes used on tramway vehicles (35,093—*175,823*)—S. Thomas.
Lifting jacks (35,428—*175,833*)—Metall-Industrie und Handels-Ges. and F. Ilsemann.
Emergency brakes for rail track vehicles (29,676—*176,041*)—W. F. Rafferty and F. M. Haines.

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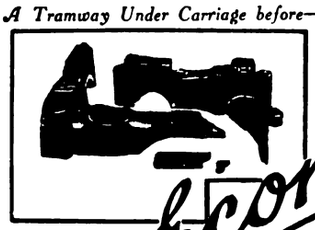
Hand Operated Double-Bladed Rail Cutter *(McMurdo's Patent)*
WILL CUT THROUGH A 7 in. × 7 in. TRAMWAY RAIL IN 20 MINUTES
The machine is fitted with two 14 in. × 1 in. hacksaw blades which cut simultaneously into the rail, thereby practically halving the cutting time. It is hand operated by one man and is portable. The machine holds the rail and not the rail the machine.
Railway Supplies Co. Limited,
68 Victoria Street, Westminster, S.W.1.

A Tramway Under Carriage before—

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—and the Oxy-Acetylene Process
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Liquid fuel supply for motor vehicles (33,486—*176,105*)—Guy Motors, Limited, and E. J. D. Buckney.

1921

Apparatus for holding fishplates in position when welding tramway rail joints (11,387—*175,216*)—G. Wallace and H. Bolton.
Lifting jacks (2,289—*175,514*)—J. Tatton.
Insulators for conductor rails (2,307—*175,515*)—W. H. Meyrick.

FOR SALE.

POWER STATION AND EQUIPMENT.

The Corporations of Middlesbrough, Thornaby-on-Tees and Stockton-on-Tees having taken over the undertaking of the Imperial Tramways Company, Limited, in the three boroughs, have for sale portions of the land, buildings, machinery and plant which are not required by the Corporations in connection with the running of the tramway undertaking subsequent to the transfer.

The particulars are as follows—

(1) Buildings utilised by the Imperial Tramway Company for the purpose of generating electricity, and consisting of—

Power House, measuring or containing 335,610 cubic feet.
Boiler House, containing 193,031 cubic feet.
Offices containing 21,546 cubic feet.
Smoke Stack of best pressed bricks and lined with fire bricks.
All necessary foundations for the machinery.
A Wharf, 200 ft. long, abutting on the River Tees, constructed of pitch pine timber and red deal, with 336 sq. yds. of slag pitching.
Boundary Walls, together with freehold land upon which the buildings are erected and adjacent and incident thereto, containing 426 sq. yds. or thereabouts.

The buildings are built of best pressed brick, the Power House being lined with glazed bricks.

The Power Station is equipped with 3 Corliss Horizontal Compound Condensing Engines, direct-coupled to 3-phase, 25-cycle, 2,500 volt Generators, 2 Rotary Converters, 25-cycle, wound to give 500 to 550 volts on D.C. side, Rotary Converter Booster, Switchboard, Overhead Travelling Crane, Motor-driven Centrifugal Circulating Pump, 3 Babcock and Wilcox Boilers, evaporation 12,000 lbs., with Vickers' Mechanical Stokers, Electric Motor for driving Mechanical Stokers, Green's Economiser, Coal Bunkers, Coal Elevator (fitted with Avery's Automatic Weigher), Electric Grab Crane, Cables, Piping, Electric Lighting Equipment, and other forms of plant and machinery necessary for a fully-equipped Electricity Generating Station.

The whole of the above are situate and adjacent to Bridge Road, Stockton-on-Tees, and abut upon the River Tees a little to the west of the Victoria Bridge, which crosses the Tees at or near to that point.

The buildings, which were erected about 22 years ago, are built in a most substantial manner, and are in good order and condition.

The plant has likewise been kept in first-class running order.

In addition to the above, there is also for sale—

(2) Plant and Machinery in the Newport Sub-station situate in Newport Road, in the Borough of Middlesbrough, consisting of—

Three Rotary Converters, Single-phase Air-cooled Transformers, Centrifugal Fans, Electric Motors, Switchboard, 13 Panels, and all necessary Cables.

(3) Also the following plant now at Bridge Road premises, Stockton-on-Tees—

Weighbridge, Hydraulic Lifting Jack, Axle Tester, Hydraulic Rail Bender, Hydraulic Punching Bar, Wells' Light, Snow Sweeper, Hand Ambulance.

Tenders are invited for the purchase of—

(1) The Land, Buildings, Machinery, and Plant as described above, situate in or near to Bridge Road, Stockton-on-Tees.
(2) The Plant and Machinery at the Newport Sub-station.
(3) The Miscellaneous Plant, or, alternatively, tenders under the head of 1, 2, and/or 3 separately or any two of them.

Particulars and Conditions of Sale and permission to view can be obtained from the undersigned, to either of whom sealed Tenders must be sent not later than May 30, 1922.

Please mark envelopes "Tenders for Tramway Premises or Plant."

The Corporations give no undertaking to accept either the highest or any other tender or tenders that may be sent in.

PRESTON KITCHEN,
Town Clerk and Clerk to the Tramways Committee,
Municipal Buildings, Middlesbrough.

THOS. DOWNEY,
Town Clerk and Clerk to the Stockton and Thornaby Joint Tramways Committee, Borough Hall, Stockton-on-Tees.

April 6, 1922.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED Mar. 12	Mar. 19	Mar. 26	April 2		1922. WEEKS ENDED Mar. 11	Mar. 18	Mar. 25	April 1		AGGREGATE. Wks.	1921-22.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,289	3,377	3,468	3,481	...	3,294	3,272	3,132	3,154	...	43¾	152,456	− 13,059
Aberdeen Motor Buses	52	54	57	63	...	128	143	132	143	...	43¾	9,860	+ 8,435
Ayr Corporation	548	549	578	665	...	485	496	470	461	...	46	31,912	− 2,622
Barrow Corporation	879	884	947	943	...	598	607	584	580	...	52	41,923	− 5 097
Belfast City Tramways	12,006	12,519	12,515	12,551	...	11,745	11,770	11,317	11,565	...	52	647,618	+ 48,333
Birkenhead Corporation	2,590	2,619	2,511	2,771	...	2,550	2,485	2,411	2,512	...	¾	710	− 419
Birkenhead Motor 'Buses	390	408	519	595	...	543	560	515	553	...	¾	195	− 70
Birmingham Corporation	31,546	31,407	30,410	32,156	...	29,209	28,524	27,691	27.858	...	52	1.512.000	− 133.544
Birmingham Motor 'Buses	1,860	1,866	1,932	2,324	...	2,022	1,706	1,589	1.613	...	52	100,998	− 3,192
Blackburn Corporation	2,419	2,362	2,414	3.711	...	2,264	2,206	2,135	2.173	...	52	116,123	− 11.411
Bradford Corporation	13.944	14,465	14,152	16.364	...	13,532	13,777	13,758	13.286	...	¼	3,028	− 2.329
Burnley Corporation	3,531	3,316	4,184	3,666	...	3,178	3,246	3,237	3,099	...	—	—	—
Burton-on-Trent Corporation ...	611	654	676	681	...	585	555	550	547	...	52	32,079	+ 42
Bury Corporation	2.527	2,373	2,961	1,427	...	2,465	2,343	2,235	1.457	...	52	125,401	− 6,312
Chatham and District	1,593	1,619	1,716	1,994	...	1,490	1,563	1,407	1,498	...	13	18,565	− 2,517
Chesterfield Corporation	642	640	630	711	...	579	551	528	529	...	52	30,204	− 1,181
Chesterfield Motor Buses	868	858	834	1,018	...	728	681	669	665	...	52	38,965	− 3.525
Derby Corporation	2,220	2,301	2,547	2,609	...	2,098	2,025	1,933	1,960	...	52	110,918	− 8,662
Dundee City	3,004	3,076	3,047	3,251	...	2,926	2,891	2,809	2.808	...	45¾	143,600	+ 4,006
East Ham Corporation	2,139	2,197	2.308	2,253	...	2,191	2,159	2,055	2,130	...	52	110,294	+ 1,692
Edinburgh Corporation	...	...	...	...	...	11,145	11,232	11,134	11,147	...	46	572,704	− 40 212
Edinburgh Motor 'Buses	...	...	...	...	...	3,202	3,204	3,143	3.185	...	46	161,530	—
Glasgow Corporation	46,399	46,048	46,458	44,260	...	44,280	45,126	43,326	45.233	...	43¾	1,964,160	− 3.362
Glossop (Urban Elec. Supply Co.)...	218	227	290	248	...	233	233	206	217	...	13	2,953	− 137
Halifax Corporation	4,133	4,327	4,210	5,582	...	3,890	3,896	3,819	3,825	...	50¾	219,641	− 3.200
Halifax Motor 'Buses	111	113	110	150	...	64	57	58	68	...	50¾	3,913	− 1,917
Halifax Railless Cars	...	...	...	...	...	48	53	48	35	...	36	1,871	—
Huddersfield Corporation	5,307	5,300	5,520	6,665	...	4,833	4,940	4,874	4,939	...	1	4,939	− 1,725
Ilford U.D. Council	1,389	1,427	1,446	1,482	...	1,470	1,430	1,387	1,434	...	52	77,687	+ 9.814
Ipswich Corporation	824	848	962	977	...	747	737	680	707	...	52	43,900	− 5.846
Isle of Thanet...	545	572	579	1,367	...	529	589	525	553	...	25¾	15,413	+ 230
Kilmarnock Corporation	353	365	374	...	...	320	317	304	...	...	44¾	15,914	− 685
Leicester Corporation	6,331	6,474	6,553	7,547	...	7,146	7,191	7,001	7,105	...	13	92,673	+ 7,452
Liverpool Corporation	29,506	32,568	29,649	30,854	...	28,962	29,260	29,559	28.679	...	13	373,842	+ 5,127
London County Council	99,942	101,551	102,314	102,940	...	92,928	93,726	90,820	90,509	...	52	5,045,561	+ 157,986
Maidstone Corporation	412	420	446	525	...	397	402	380	441	...	52	24,118	− 755
Manchester Corporation	37,884	37,333	38,985	31,335	...	37.232	37,734	35,864	29,436	...	52	1,998,403	+ 174.752
Newcastle-on-Tyne Corporation ...	11,335	11,357	11,665	...	...	Strike	Strike	8,245	...	...	51	534,737	− 32.934
Nottingham Corporation	7,348	7,574	8,215	8,479	...	7,663	7,424	7,371	8,774	...	52	361.139	- 41.227
Oldham Corporation	4,592	4,531	5,040	5,046	...	4,689	4,534	4,447	4,378	...	1	5,895	− 1.643
Preston Corporation	1,865	2,003	1,856	2,338	...	1,832	1,740	1,692	2,165	...	52	98.562	+ 2.637
Preston Motor 'Buses	...	...	...	...	...	135	127	124	159	...	9¾	1,268	—
Reading Corporation	1,512	1,562	1,663	1.752	...	1,529	1,502	1,415	1,445	...	52	81,525	− 4,350
Reading Motor 'Buses	246	270	296	387	...	317	302	286	278	...	52	17 361	+ 3.481
Rotherham Corporation	2,622	2,675	2,625	2,830	...	2,274	2,209	2,133	2,152	...	51	115,064	− 21.620
St. Helens Corporation	2,078	2,125	2,016	2,405	...	1,627	1,597	1,524	1.515	...	52	91,333	− 17.356
Salford Tramways	10,645	10,332	10,821	12,046	...	10,378	10,362	9,891	10,088	...	1	10,088	− 1,958
Sheffield Corporation...	20,062	20,411	20,269	22,111	...	18,568	18,241	17,959	17.884	...	52	1,003.402	− 80,739
Southampton Corporation	2,934	2,964	3,056	3,474	...	2,883	2,893	2,820	2,849	...	52	153.161	− 10,084
Southampton Motor 'Buses	176	180	180	179	...	101	97	94	98	...	52	7,581	− 4,747
Southend Corporation	1,646	1,730	1,733	2,904	...	1,941	1,964	1,930	1,938	...	52¾	126,014	+ 7,750
South Shields Corporation	1,883	1,897	2,033	1,391	...	1,690	1,680	1,608	1,267	...	52	88.183	− 12.704
Sunderland Corporation	2,730	2,864	2,902	1,845	...	2,497	2,401	2,456	1,734	...	52	134,544	− 22,643
Swindon Corporation	355	368	370	463	...	337	325	318	323	...	51¾	19,948	− 127
Tyneside Tramways and Tramroads	1,096	1,157	1,170	2,386	...	697	688	702	820	...	13	9 916	− 5,839
Wallasey Corporation	2,588	2,619	2,600	2,978	...	2,527	2,390	2,298	2,333	...	52	142,761	+ 6,300
Wallasey Motor 'Buses	141	150	152	238	...	211	189	200	191	...	52	12,118	+ 3 285
Walsall Corporation	1,825	1,885	1,924	1,645	...	1,654	1,632	1,571	1,252	...	52	85,116	− 9,976
Walsall Motor 'Buses	1,231	1,240	1,350	1,200	...	954	917	906	629	...	52	48,470	− 13,753
Walthamstow U.D. Council	1,889	1,933	2,158	2,256	...	1,789	1,838	1,680	1,724	...	52	103,703	− 2,109
Warrington Corporation	1,060	1,071	1,088	1,084	...	1,038	987	963	1,024	...	52	51,945	− 786
West Ham Corporation	6,081	6,143	6,266	6,649	...	5,621	5,679	5,459	5,428	...	52	304,762	− 730
Wolverhampton Corporation ...	2,218	2,274	2,621	1,993	...	2,318	2,159	2,178	1,657	...	52	120,624	− 4.719
Wolverhampton Motor 'Buses ...	630	603	852	546	...	649	627	634	506	...	52	33,936	+ 8,769

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED Mar. 12	Mar. 19	Mar. 26	April 2		1922. WEEKS ENDED Mar. 11	Mar. 18	Mar. 25	April 1		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	
Underground Rlys. & L.G.O. Co. ...	225,485	227,665	227,360	241,706	...	218,814	220,159	210,322	213,069	...	13	2,742 088	− 229,889
London and Suburban Traction ...	50,292	50,617	53,343	57,377	...	48,900	49,051	45,562	46,092	...	13	596,548	− 58,700

Colonial and Foreign Tramway Traffic Returns.

Companies issuing Weekly Returns.

NAME OF COMPANY.	1921. WEEKS ENDED Mar. 12	Mar. 19	Mar. 26	April 2		1922. WEEKS ENDED Mar. 11	Mar. 18	Mar. 25	April 1		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	82,703	84,018	72,461	79,540	...	88,613	83,869	86,730	85,049	...	13	1,082,674	+ 47,482
Calcutta ... ... Rs.	81,297	83,051	78,740	79,537	...	111,612	101.866	106,616	109,676	...	13	1,372,411	+ 564,936
Madras... ... ... Rs.	(2 weeks)	41,016	(2 weeks)	56,919	...	(2 weeks)	49,857	(2 weeks)	47,773	...	13	291.232	+ 145.588
Pernambuco	4,757	4,219	3,763	3,929	...	3,746	3,670	3,624	3,340	...	13	48,917	− 12.308

Companies issuing Monthly Statements only.

	1920. Oct.	Nov.	Dec.	1921. Jan.	Feb.	Mar.	1921. Oct.	Nov.	Dec.	1922. Jan.	Feb.	Mar.	Wks.	AGGREGATE. 1921-22.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4,442	4,810	4,601	5.342	4,594	...	4,682	5,137	4,762	5.565	4,805	...	44	50,657	+ 3,120
Brazilian Trac. Mlrs	1,344200	12199000	12600,000	12875000	11941000	...	15016000	14555000	15405000	15032000	14473000	...	8	29,505,000	+ 4,689,000
Brisbane	46,310	...	...	46,280	43,205	46,300	47,880	...	...	48,790	43 800	51,300	13	143,890	+ 8,105
British Columbia	$ 835,054	858.842	917.668	908,385	838,682	...	845,973	877,335	940,113	907,242	821,828	...	34	6,921,985	+ 157,547
Buenos Ayres L'c'z	57,619	56,746	68.857	61,111	53.952	59,365	58,492	58,056	63,381	61,198	55,227	61,775	39	521,819	+ 11,105
Burma	55,763	53,696	50,481	50,035	48,405	...	64,778	58.271	54,194	59,362	52,380	...	30	403,127	+ 45,959
Cape Town ...	...	25.628	29,768	...	...	...	26,839	27,004	31,521	30,289	26,980	...	—	—	—
Carthagena & H. ...	3,319	2,714	5.560	3,877	2,839	2,226	3,862	1.717	3.237	3,075	2,773	2,145	13	7,993	− 949
Cordoba	19,627	19,122	19,299	18.696	...	...	23,203	22,698	22,641	22,152	...	...	43	230,068	+ 32,934
East India ...	4,299	4.234	4,271	4,299	3,819	4,168	4,054	3,945	4,058	4,080	3,737	4,446	34	33,017	− 410
Kalgoorlie... ...	3,094	2,969	3,140	...	...	...	2,406	2,419	2,814	...	...	...	52	27,758	− 9,054
La Plata	6,310	5,573	...	6.506	*728	*3,403	6,587	6,453	...	6,724	6,318	7,067	13	20,109	+ 9,471
Manila ...	$ 327,652	320,345	315,599	321,449	306,389	...	323,108	306,850	316,467	309,252	310,001	...	8	619,253	− 8.585
Monte Video ...	45,246	43,846	...	50,863	48,119	48,925	47,927	47,426	...	32,634	48,111	51,158	21	231,459	− 9.229
Para	26,772	24,273	24,253	24,231	20,545	...	25,548	23,147	22,660	22,966	21,582	...	13	67,208	− 1,821
Port Elizabeth ...	...	6,620	8,185	...	...	...	6,788	6,828	8,344	8,120	6,690	...	—	—	—
Rangoon ...	Rs. 111,830	104,468	120,000	122,588	120,718	...	151,000	137,750	145,500	137,850	130,583	...	8	268,433	+ 25,157
Winnipeg ...	$ 444,899	477,957	...	506,229	460,125	...	441,315	477,880	...	507,047	498,577	...	8	1,005,624	+ 39,270

* Strike of Employees.

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United Automobile Services, Ltd.,
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Dear Sirs, 16.11.1921.

"I am rather pleased at the record made by your Chassis No. 15363, which was placed in service by us on 1st July, 1920, and which is now about to come in for overhaul.

This chassis has now covered a total of 60,500 miles without coming in for heavy repairs."

Yours faithfully,
(Sgd.) E. B. HUTCHINSON,
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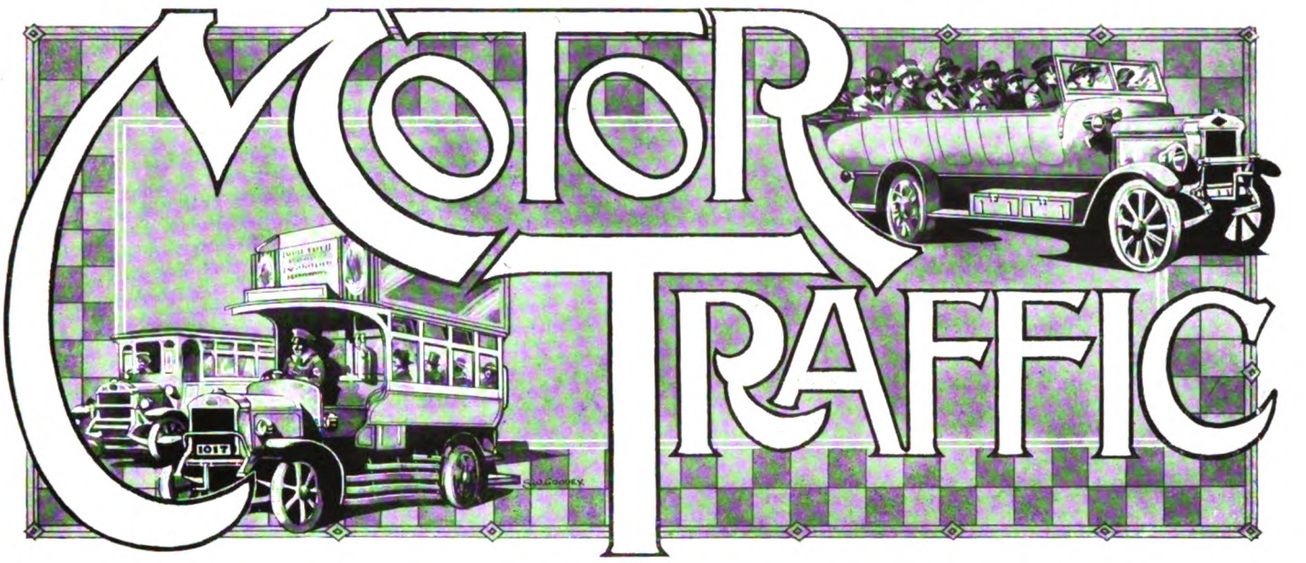

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

THE SEATING OF MOTOR COACHES.

As regards the arrangement of seating accommodation the motor coach exists in a great number of varieties. The general tendency in the future will probably be towards the employment of rather smaller vehicles, but, unless the largest types are rendered useless in many districts by the arbitrary closing of roads against them, these will still continue to be employed in considerable numbers wherever the main problem is to provide accommodation at a low cost per head. In the popular type of coach, every inch of space must be utilised, even if certain inconveniencies are thereby caused. Thus, for instance, the arrangement of seats on either side of a central gangway, with a single entrance at the rear, means some loss of space which might be devoted to the carriage of a paying load. On the other hand, continuous transverse seats with side doors are inconvenient if passengers are taken up and set down singly, or if particular seats are allocated in advance. In such cases, considerable disturbance is caused to a number of other passengers when one passenger wishes to get in or out. This disturbance could be reduced by putting side doors at each end of each seat, but this plan is not generally recommended, because it weakens the whole structure of the body. In some cases, in which the central gangway method is employed, folding seats are provided which block the gangway when the vehicle is full. These folding seats are generally inferior in the matter of comfort, and the blocking of the gangway by them causes confusion when the vehicle is loading and unloading, especially when passengers are to be set down individually. In the higher class coaches, double bucket seats on either side of a central gangway are sometimes provided, or we may go a step further and provide single bucket seats, slightly staggered in position so as to give more elbow room. The coach de luxe in which the problem is to provide the maximum of comfort, more or less regardless of economy, is a totally different proposition. In some districts and for some purposes it may be the most paying type, but to the majority of holiday makers, the cost of accommodation is prohibitive. One further point may be mentioned as being allied to the subject of this note. This is the provision of facilities for passengers entering or leaving the vehicle. The floor is some distance above the pavement and two steps are generally necessary. Some arrangement ought therefore to be adopted by means of which the lower step can be made to project further outward than the upper step. In that case the lower step must generally be hinged, so that when the passengers are in the vehicle it can be folded inwards and does not constitute a dangerous projection.

SPECIAL MOTOR ROADS.

More than one project is now on foot for the construction of motor roads to link up important industrial centres in Great Britain. Projects in some respects similar were mooted many years ago, but in those days the main idea was to provide a track for fast private car traffic. Now the idea is rather to improve the facilities for the cheap operation of industrial vehicles. Whether any of these schemes will mature or not, it is difficult to say. One doubtful factor is the reception they will get in Parliament. Another is the question of whether the tolls received for the use of the roads could possibly be sufficient to pay fair interest on the capital invested after meeting maintenance and management charges. Undoubtedly, motor traffic, even under present conditions, is a dangerous competitor of railway traffic over all moderately short distances. If the conditions are improved by providing really suitable smooth, wide and graded roads, the length of haul over which the motor will have the advantage of the railway will be much increased, and this may still be true after a substantial toll has been paid by the motor for the use of the special road. This special road would, no doubt, be linked up in some way to existing roads, so that we should go rather near to combining the advantages of the two systems; namely, the speed possibilities of the railway over direct long distance journeys, and the elimination of intermediate loading details, which is so great an advantage of motor traffic. All such schemes are, however, as yet on paper, and none of them can be regarded as an immediate possibility.

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MOTOR TRAFFIC

THE LAW AND THE TRAILER.

Though the new regulations which are to take the place of the old Heavy Motor Car Order have not yet been approved by Parliament, the nature of the recommendations to be made by the Committee of the Ministry of Transport and, presumably, by the Ministry itself to Parliament, is now fairly generally known. It is apparent that the Committee now realises the importance of improving the economy of transport by encouraging the wider use of trailers under more favourable conditions.

The first difficulty is to define what a trailer is. The suggested definition is that a trailer is "any vehicle drawn by a mechanically-propelled vehicle, other than a sidecar attached to a motor bicycle." This definition is imperfect. For one thing it does not clear up the position as regards the after portion of a flexible six-wheeled vehicle. Is this after portion a trailer, or is it a part of the vehicle itself? It can be detached from the power-driven portion and has considerable power of independent movement, and might quite conceivably be regarded as coming within the above definition of a trailer. In that case, a flexible six-wheeler would be subject to the same disabilities as the trailer combination as regards speed limits, and its development would be impeded if not stopped altogether. Another doubtful case is that of a vehicle carrying no power plant of its own; but designed to run behind a power-driven vehicle and provided with means of positive propulsion of two or more of its wheels. Thus, for instance, the following vehicle might be fitted with electric motors supplied with current from a dynamo driven by the engine of the power vehicle. In that case, the following vehicle is not, strictly speaking, drawn in the ordinary sense of the word, and one is left wondering whether it would be classified as a trailer or not.

The recent increase in legal unladen weights of power vehicles is one of the necessary preliminaries towards the extended use of a trailer. So long, however, as the limits of laden weight is put at 12 tons, the petrol vehicle manufacturer is in something of a dilemma. If he produces a power vehicle weighing 7¼ tons unladen, he has a margin of only 4¾ tons for useful load. The vehicle should be capable of carrying considerably more than this, even on hilly roads. The vehicle cannot, therefore, be fully utilised unless it draws a trailer, and this, in the future as in the present, though to a less degree, will mean a reduction in the speed limit.

This difficulty is realised, and it is now proposed that the limit of laden weight should be raised to 14 tons for a self-propelled vehicle of normal design, or to 22 tons for the vehicle and its trailer together. This will probably be coupled with a maximum legal axle weight of 10 tons for the vehicle and 6½ tons for the trailer. Assuming these alterations to be made, the way is open to the construction and use of very substantial petrol vehicles weighing about 7 tons unladen, carrying approximate 7 tons and drawing an additional 4 tons in a trailer, wherever road conditions permit. The very heaviest types of vehicles will probably be limited to a speed of 8 miles an hour, and this speed will apply also to the somewhat lighter types if trailers are drawn. For the heaviest types, therefore, the trailer would be encouraged as definitely increasing the working capacity. In connection with the rather light types, the loss in speed will more or less balance the increase in carrying capacity when the trailer is used. The position will, however, be considerably better than it is now, since, under the present law, the use of a trailer behind a petrol lorry entails a reduction in working capacity if legal restrictions are observed. Special provision will be made for quite light pneumatic-tyred trailers, which will be permitted behind comparatively light pneumatic-tyred vehicles travelling, probably, up to 16 miles an hour without breaking the law.

It is understood that special regulations will be made in the interests of the flexible six-wheeler. It does not appear that these regulations would be necessary if speeds were determined solely on the basis of axle weights. If, however, as is apparently intended, speeds will depend also on unladen weights, a schedule suitable for a four-wheeler will not be suitable for a six-wheeler, which can be given considerably larger unladen weight without excessive axle weights being involved. On the whole, the forthcoming regulations will give improved prospects of economy along three lines, namely, by the more efficient use of trailers of greater capacity and at higher speeds, by the use of flexible six-wheelers under better conditions, and by the use of pneumatic-tyred vehicles at reasonable speeds, calculated to increase their working capacity sufficiently to justify the higher maintenance costs of the pneumatic tyres.

MOTOR COACH SEASON.

LANCASHIRE TRAMWAY COMPANY'S PLANS.

With the opening of the motor coaching season the Lancashire United Tramways, Limited, of Atherton, have lost no time in making known to the public the extensive and well-organised system of coach tours which they conduct. Mr. E. H. Edwardes, the general manager, has just issued the 1922 edition of the company's admirable little guide-book, "Touring by Motor Coach," the price of which, we notice, is now 1s. instead of 1s. 6d. as hitherto. Its one hundred pages contain attractive descriptions and photographs of many of the places of interest visited on the tours and several excellent maps of the ground covered. An indication of the increasing popularity of this form of holiday is afforded by the fact that the company's fleet of coaches has increased from three, which sufficed when the tours were commenced eight years ago, to 70 now in use. With their centre at Atherton, the company are well situated for providing the large surrounding industrial population with facilities for visiting some of the most charming scenery in the country—that of North Wales, the Lakes, and the Pennine Dales, all of which districts lie within one day's "out and home run." Their policy this year will be to offer single-seat bookings for day and half-day outings, week-end tours to Wales, extended tours and trips by the company's special Austin 6-seater landaulettes. The regular services will include a daily run to Blackpool, a bi-weekly service to Llangollen, and a weekly journey to Southport. It is also hoped to establish half-day services on Saturdays, Sundays, and Wednesdays. An equally complete programme will be conducted from the Liverpool depot of the company, whence coaches will run to Chester, Delamere, Llangollen, Ruthin, and the Lancashire coast resorts.

The Welsh week-end and extended tours proved very popular when inaugurated last season. First-class accommodation is reserved for each passenger at selected hotels. The company also intend to run coaches to all the principal sporting events, and their ability to deal with large "works' outings" was typified by their success on one occasion in carrying 1,452 persons in 56 vehicles.

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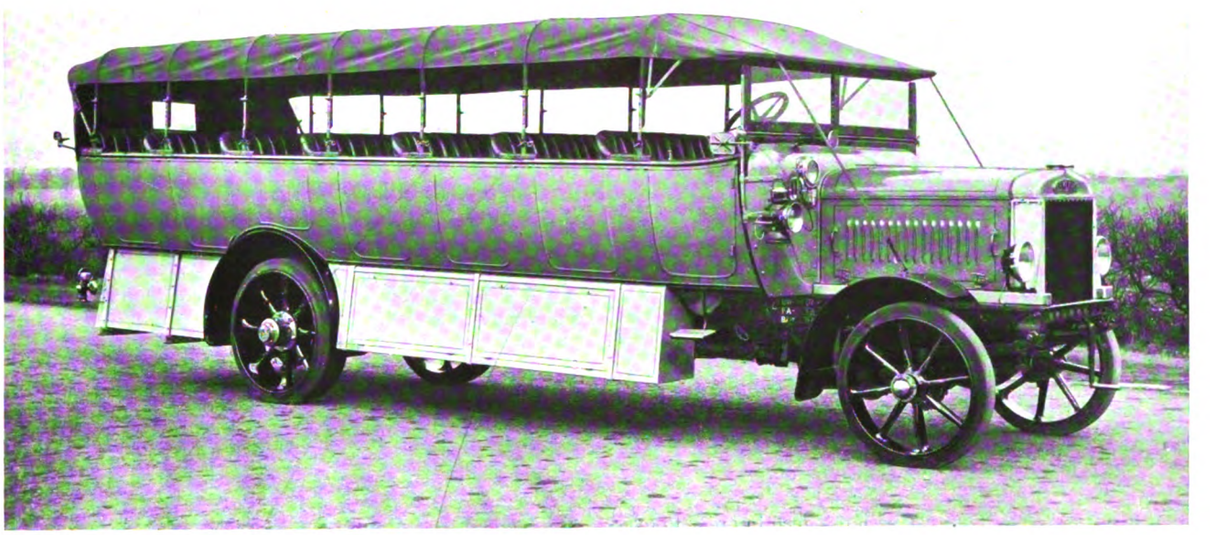
MOTOR TRAFFIC

LEYLAND MOTOR COACH WITH SPECIAL LOCKERS.

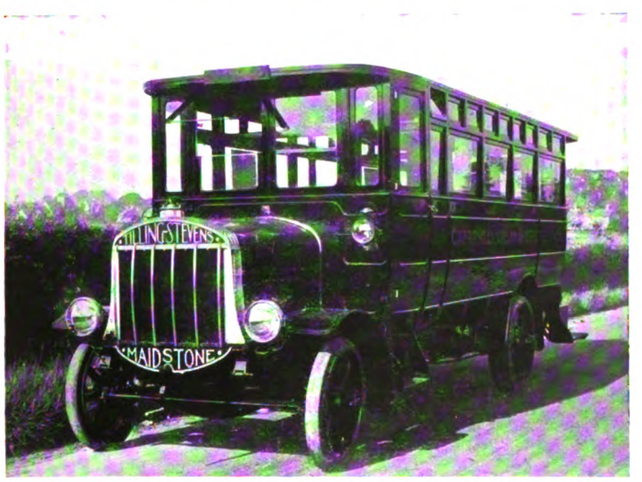
It has always been a problem how successfully to arrange for the carriage of passengers' luggage on motor coaches without discomfort to the tourist. One of the latest Leyland coaches just delivered from their works, which is shown in the accompanying illustration, has been equipped with spacious luggage lockers, which are fitted on the off-side of the vehicle and also at the rear. There are various compartments, and each can be locked, thus securing the safety of passengers' luggage. As the extra expense for fitting such lockers is comparatively small, the Leyland Company seem to have hit upon an excellent arrangement.



Leyland Motor Coach showing Luggage Lockers.

WELSH ORDER FOR TILLING-STEVENS.

In March of last year, the Caerphilly Urban Council began operating omnibuses with several single-deck petrol-electric omnibuses supplied by Tilling Stevens Motors, Limited, of Maidstone. The council's experience of these vehicles has proved so satisfactory that another of the same standard type was ordered and has recently been delivered. The single saloon seats 28 people.



Tilling-Stevens Petrol-Electric Omnibus.

NEW ZEALAND'S "COMMER" OMNIBUSES.

The Commercial Car Company have supplied a number of their 3P passenger chassis with 30-seat body to the Palmerston North Borough Council, New Zealand. Fitted with twin pneumatic tyres on the rear wheels and single on the front, the vehicles provide luxurious travelling, the seats being upholstered in dark green and thoroughly sprung. The disc wheels are interchangeable. The entrance is on the side near of the driver. With the exception of one row the seats are arranged to face the entrance, and a gangway runs down the centre. At night the saloon is lighted by electric lamps let into the roof. The 3P passenger chassis has an engine of 40 H.P. with four cylinders. Power is transmitted through the "Commer" gear box, which has four speeds and a reverse, and thence through an intermediate and propeller shaft to the full floating live axle. The body is strikingly finished in brilliant red with silver-plated fittings.

"Commer" Omnibus in New Zealand.

BRIGHTON TROLLEY OMNIBUSES.—The Ministry of Transport has, it is reported, extended the time to August 1923 for the installation of trolley omnibus equipment under the Brighton Corporation Act 1921, and the Order 1917.

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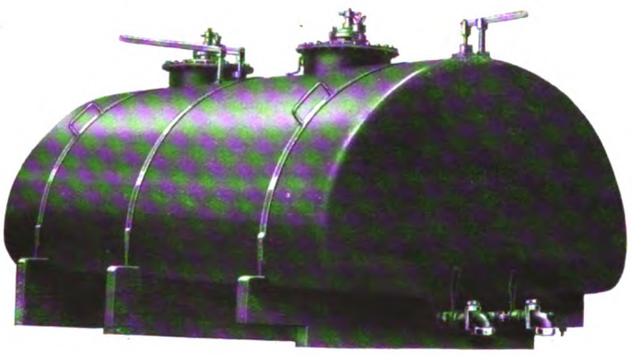
MOTOR TRAFFIC

MAUDSLAY SADDLE TANK WAGON.

The new type of saddle tank wagon illustrated below represents the latest method of transporting motor spirit by road, and has just been introduced by the Maudslay Motor Company, of Coventry. It embodies a number of features which show a marked improvement upon the older type of wagon, and is fitted with an asbestos fireproof screen which conforms to the new regulations governing the transport of motor fuel.

Maudslay Saddle Tank Wagon.

The D-shaped or saddle tank has been designed in order to overcome the disadvantages of the ordinary cylindrical tank. It is made by the Steel Barrel Company, Limited, of Uxbridge, who for many years have enjoyed a high reputation as makers of all types of tanks. The chief disadvantages of the cylindrical tank is the height and high centre of gravity. In the saddle tank the overall height is considerably less, while the low centre of gravity not only permits larger tanks to be safely used, but reduces the strains and stresses set up in the chassis to a minimum, with a consequent lengthening of life both in the chassis and the tyres. The



D-Shape Tank with Standard Fittings.

illustration of the unmounted tank shows it complete with standard fittings approved by the London County Council.

The tank wagon shown is one of six 1,000 gallon machines supplied to the proprietors of "Flight" spirit fuel. It is mounted upon the Maudslay 4-ton chassis, of which the following is a brief specification—The side members of the frame are of rolled steel channels built up with tubular cross members and bolted together, no rivets being used. The engine is the Maudslay standard 40-H.P. motor with overhead valves, the cylinders having a bore and stroke of 5 inches. The gear box is of the sliding type, with four speeds and a reverse. The ample proportions of the shafts, together with the short distance between the bearings, is an important feature in its design, and makes for great rigidity. The final drive to the back axle is by means of a double reduction gear, spur and bevel gears being used. The gears, together with the differential, are suitably mounted, and provided with roller journal bearings and ball thrust bearings. The back axle is the well-known Maudslay banjo type, forged solid in nickel chrome steel, which has stood the test of time so well under all conditions of load and road. Ackermann type steering gear is fitted, with strong irreversible worm and segment, all joints being of the cup and ball joint type. The springs are of ample size and length, and are made of the finest spring steel with solid forged eyes. Two powerful brakes are fitted; the hand brake operates on the rear wheels, to which brake drums of large diameter are fitted, the brake anchorage being rigidly mounted on the axle. The foot brake acts upon a drum mounted at the rear of the gear box. The ignition and throttle levers are placed underneath the steering wheel on a quadrant at the side of the steering column, and is not affected by the steering. A foot accelerator is also fitted, which works independently of the hand throttle lever. The overall length of the chassis is 21 ft., giving a free loading space of 12 ft. 4½ in. behind the driver's seat, the wheel base being 13 ft. 6 in.

THORNYCROFT TOWER WAGONS FOR COPENHAGEN.

The photograph reproduced below illustrates one of two tower wagons built on two "J" type chassis supplied to the Copenhagen Tramways through the Scandinavia house of John I. Thornycroft and Company, Limited, at Copenhagen. An interesting feature

Thornycroft Tower Wagon for Copenhagen Tramways.

of the machine is the separate compartment behind the driver's cab for the accommodation of the linesmen. The bodywork was constructed in the tramways workshops.

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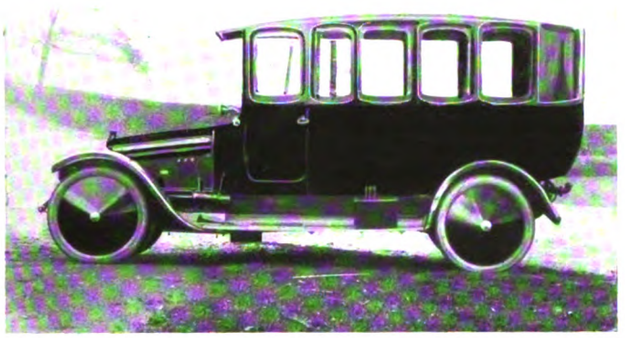
MOTOR TRAFFIC

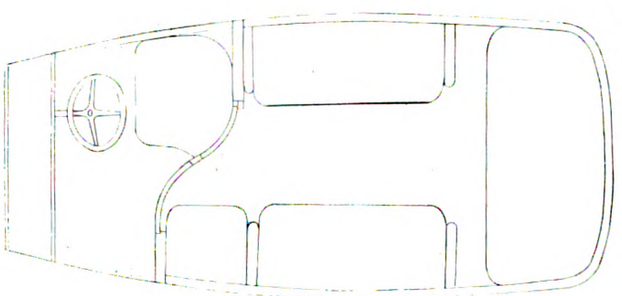
BRADFORD'S COMMITTEE CAR.

A notable feature of the administrative methods of Bradford Corporation is a "committee car," which is used by various sub-committees and officials to visit parts of the city where municipal work is in progress. The body, which was designed by the tramways staff and made at the tramway works, accommodates eight persons, so that it is possible to conduct an appreciable amount of business during the journeys. The facilities thus provided for intercourse and discussion between members of the committees have naturally resulted in great economy of time and have proved a distinct advantage in every way. We are indebted to Mr. R. H. Wilkinson (general manager of the city tramways) for the following description of the committee car—



Bradford Corporation's Committee Car.

The chassis is a Crossley 25-30 H.P. R.A.F. type and was purchased from the Government Disposal Board. The body for which, as stated, the tramways department was responsible, is of the saloon type, with front entrance. A bucket seat, upholstered in leather, is provided for the driver, and at his near side is a door leading to the interior of the vehicle. The seating accommodation allows a space of 24 in. for each of the eight passengers. The seats are so arranged as to facilitate consultations *en route*. The seat at the back is placed transversely and accommodates three passengers. The floor at the rear of the body is raised 5 in. above the centre and forward part, affording the passengers on this seat a clear view for intercourse with the remaining passengers, and an uninterrupted outlook through the front windows. Two seats, with accommodation



Arrangement of Seats in Bradford Committee Car.

for two passengers each, are arranged one along each side of the vehicle, while on the near side, between the side seat and the entrance, is a tip-up seat for one person. The committee car is equipped with a self-starter and electric lighting set. Speaking tubes provide easy communication with the driver. The constructional details of the body are as follows—

All framework is of teak, and the outside is of beaten steel electrically welded to form one continuous whole. The windows are of plate glass, bevelled edged, framed in mahogany, the outer edges of the frames being fitted with heavy felt linings so that there is practically no noise from the windows while the vehicle is travelling. All the linings of the car are in dark brown Bedford cord, with trimmings to match. The seat cushions are of deep construction and afford very comfortable riding. The exterior of the car is finished in Prussian blue, with facings picked out in black. The general appearance of the car, as will be gathered from our illustration, is most pleasing.

PASSENGER TRANSPORT IN THE LAKE DISTRICT.

One of the earliest, if not the first, of motor coaches in use in this country is shown in the subjoined photograph. It was supplied by J. I. Thornycroft and Company, Limited, of Smith's Square,

A Thornycroft Coach Operated in 1904.

S.W.1, in 1904, to the Lake District Road Traffic Company, of Ambleside. The picture is interesting as showing the advance which has been made in body building. At that date the accommodation for passengers was but little better than was provided on the horse-drawn chars-a-banc. The Ambleside Company were pioneers in motor coach services in this country, and have ever since been consistent users of Thornycroft coaches, of which they run an extensive fleet. From their headquarters at Ambleside

40-H.P. Thornycroft Omnibus for Lakeland Traffic.

the Lake District Road Traffic Company are now catering not only for the tourist traffic, but ordinary daily passenger movement in the Lakeland district. The handsome manner in which this traffic is provided for will be gathered from a glance at the Thornycroft omnibus also shown on this page. This saloon vehicle is of 40 H.P. type "J," and it runs between Ambleside-Grasmere-Windermere. The body, by the Northern Counties Motor and Engineering Company, of Wigan, is a most creditable and comfortable example of modern body building.

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MOTOR TRAFFIC

STRAKER SQUIRE OMNIBUSES.

The accompanying photograph shows a double-deck omnibus built by Messrs. Straker-Squire, Limited, for Messrs. Harvey and Burrows, of Ware, Hertfordshire. This vehicle, from the Edmonton Works, N.18, was photographed at Waltham Cross, and it is of the special London type which secure the licence of the Metropolitan Police. It is one of three double-deck machines recently delivered to Messrs. Harvey and Burrows, with a probable purchase of six

Straker Omnibus at Waltham Cross.

more if the three are found satisfactory. The firm operate fifteen other omnibuses (single and double deck) over about 40 miles of road, the five services connecting Buntingford, Watton, and Waltham Cross with Ware and Hertford. A new route to Bishop's Stortford

Straker Double-Deck Omnibus to Seat 48.

is being opened up to connect with the National Omnibus Company's service there. A distinguishing feature of all the firm's services is their convenient change connections at various points.

WIGAN TRAMWAYS EXPERIMENT.—Wigan Corporation Tramways have agreed to suspend the running of double-deck cars on the Aspull route. They will substitute, experimentally, a service of double-deck cars converted to single-deck, or a service of motor omnibuses, or both.

COMMERCIAL MOTOR PARADE.

The 16th annual parade of commercial motor vehicles organised by the Commercial Motor Users' Association was held in Lincoln's Inn Fields, London, W.C., on Saturday, March 25, and proved highly successful. The object of the parade is to encourage drivers to take a personal interest in the driving and condition of their vehicles and to run them without accident. The parade is limited to "teams." The fact that the number of vehicles constituting a team is now three instead of six as hitherto was probably responsible for the improved entry this year. The figures were 225 vehicles entered by 32 firms, as compared with 180 vehicles exhibited by 18 firms last year. This was the largest entry yet recorded. The weather was very favourable, and the scene in the square was animated and imposing. The vehicles were lined up on all four sides, facing the centre, and much public interest was manifested in the proceedings. The silver challenge cup is awarded each year to the entrant whose "team," in the opinion of the judges' committee, is in the best condition, having regard to the class of work upon which the units are employed, the ages of the machines, and the total distances run by them. The award is made on the result of the engineer's report and the judges' inspection of the "team" on parade. Marks were given by the judges as follows—

(1) General turnout of complete teams.
(2) Condition of radiators in the case of petrol vehicles (or bunkers and tanks in the case of steamers), lamps, horns, etc.
(3) Tailboards and wings.
(4) Body work generally.
(5) Cleanliness of "under the bonnet" parts of petrol vehicles.
(6) Cleanliness of parts under driver's footboards.
(7) Cleanliness of engine of steam vehicles.
(8) Cleanliness of boiler lagging, steam fittings, etc., of steam vehicles.
(9) Cleanliness of motors of electrics.
(10) Cleanliness of batteries and terminals of electrics.

The vehicles generally were in splendid condition, though the "owner's declared mileage," ranging from 1,000 to 180,000, showed that the majority of them had already spent a more or less long and active life. The engines and bodywork were alike thoroughly clean, and the judges had difficulty in selecting the prize winners. The first prize, the "Commercial Motor" silver challenge cup, was awarded to Wethered's Brewery, Marlow, who exhibited a fine team of three Thornycroft petrol lorries. Each of the winning trio had completed over 30,000 miles in the regular service of its owners, and the condition of them all was extraordinarily good, showing scarcely any visible signs of their three years' service. (A second team of three Thornycroft lorries by the same owners was "highly commended.") The second award went to Shell Mex, Limited (the winners of the cup in 1921), whose splendid fleet included the following types of petrol-driven vehicle tanks, numbering in all a dozen—Leyland, Thornycroft, Albion, and Scammell. An even more varied array of vehicles shown by the Gas Light and Coke Company secured the third prize. These were of the following types, all petrol-driven—Commer lorry, Halley van, Napier van, Fiat lorry, Scout lorry, Straker-Squire van.

The drivers of the winning team received £2 each (and a silver medal); the drivers of the "runners-up" team, 30s. each; and the drivers of the third team £1 each.

PLYING FOR HIRE—LEGAL DECISION.

In the Divisional Court on February 13, the Lord Chief Justice delivered considered judgment in an appeal by the London Commissioner of Police, which involved the question whether motor coaches running between London and seaside resorts were coaches plying for hire within the meaning of the Metropolitan Public Carriage Act, 1869, and were accordingly required to be licensed under that Act. The appeal was against the decision of the Westminster magistrate, who decided that these motor coaches did not require to be licensed under the Act, as the people carried were in the nature of private parties. The Lord Chief Justice said the magistrate found that when the coach was standing in the street concerned no member of the public could have obtained a seat if he had not previously booked elsewhere. The process of soliciting was then over, and the driver was merely receiving passengers who had already booked. On this ground alone the magistrate was right in refusing to convict. The appeal was dismissed with costs.

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MOTOR TRAFFIC

THE VICTORY OMNIBUS COMPANY, LTD.

A New London Venture.

This company has been formed for the purpose of extending the facilities for omnibus travelling in the streets of London. A contract has been entered into with Leyland Motors, Limited, for the construction of the first fleet of 100 omnibuses, which will be of approved type embodying the latest improvements. Options have been obtained for the use of the Leyland Works, near Kingston, together with a trained staff, as a central repair depot, and also for garage sites at Lee Green, Stratford, Walham Green and Hanwell. Twenty-seven selected routes have been arranged, the majority of which will not compete with existing motor omnibus services. It is understood that the company has secured the services, as chief traffic manager, of a gentleman who for many years has been employed in all branches of motor omnibus traffic in the Metropolitan area, while the services of Mr. Percy Frost Smith, late managing director of Tilling-Stevens, Limited, have been retained as consulting engineer.

The capital of the company is £500,000, divided into 400,000 8 per cent. cumulative participating preference shares of £1 each, and 100,000 ordinary shares of £1 each. The directors are—The Viscount Maitland, chairman of the Marine and Industrial Trust, Limited, chairman; Sir Henry Bax-Ironside, director of the Westminster Electric Supply Corporation, Limited; Col. Alex. Weston Jarvis, director of Indiarubber, Guttapercha and Telegraph Works Company; Sir Percy Sykes; and Mr. Ronald A. Mason (managing director), director of the British Steamship Marine and General Insurance Company, Limited.

The prospectus is expected to be issued soon after the Easter holidays. The temporary offices are at 185 Piccadilly, W.1.

FIRE ENGINE'S DETACHABLE PUMPS.

Newcastle Fire Brigade's Acquisition.

On this page are photographs illustrating the recent delivery by Tilling-Stevens Motors, Limited, of a petrol-electric fire engine with dismountable pump, to the Newcastle-upon-Tyne Fire Brigade.

Tilling-Stevens Petrol-Electric Fire Engine at Newcastle.

The chassis is one of the well-known T.S.4 type, but has a shortened wheelbase and other special details compatible with fire engine requirements.

Although the principle of the petrol-electric is generally known, its adaptation for use on fire engines necessitates a description. A petrol engine of usual design is coupled to a dynamo, the current from which drives a motor, coupled to the rear road wheels through a propeller shaft and differential gear. This system is adapted to the requirements of fire fighting, and is embodied in the Tilling Stevens dismountable fire pump. This pump is of the two-stage, high-duty centrifugal type, and has a rated capacity of 300 gallons per minute. It is driven by a separate motor, and is designed as a separate unit, mounted on its own axle, which has large diameter artillery pattern wheels.

Normally the pump is locked on ramp plates on the chassis frame, but when required for pumping a distance away can be detached in a few seconds. A change-over switch on the dashboard diverts the current from the chassis motor to the pump motor, and from this point the pump is entirely controlled from the rear of the chassis.

The pump, being dismountable, can be man-handled to the source of water—a very advantageous feature, where it would otherwise be necessary for the whole vehicle to traverse soft ground to reach the water supply, or when the water supply is such that it would be impossible for a large vehicle to get sufficiently near. When the pump is dismounted the connection between the chassis dynamo and pump motor is maintained by a flexible rubber armoured cable, which is wound on a drum when not needed.

In addition, a first-aid pump is installed in the front of the chassis, with its hose reel immediately behind the driver's seat. This pump is so arranged that water from the 40-gallon tank, carried on the vehicle or from the town supply, can be utilised for small fires, where only a moderate supply of water is necessary. The fire engine was thoroughly tested both before and after delivery, and was found to be highly satisfactory in every way.

This machine makes the third Tilling-Stevens petrol-electric in the service of the Newcastle Brigade, previous deliveries having been a turntable ladder and a general utility wagon.

L.C.C. RAILLESS BILL.

Approval of Borough Councils to be Required.

On the motion for the second reading of the London County Council (Tramways, Trolley Vehicles and Improvements) Bill, Lieut.-Col. Pownall (Lewisham, E., C.U.) said the object of the Bill was to give powers to the London County Council to construct what was called a trackless trolley tramway from the Crystal Palace to Lee Green, and as two-thirds of the proposed tramway was to run through Lewisham, the inhabitants of that borough were strongly opposed to it, and the borough council condemned its introduction by 28 votes against eight. He therefore moved as an instruction to the Committee on the Bill to insert a provision making the erection of trolley vehicle equipment subject to the provisions of Section 23 of the London County Council Tramways (Electrical Power) Act 1900, which gave power to the local authority to veto the system of overhead tramway traction. Sir P. Dawson (Lewisham, W., C.U.) seconded the instruction. Sir A. Shirley Benn (Plymouth, Drake, C.U.) said that if the conduit system was adopted on the line projected it would mean an expenditure of £600,000, whereas the trackless trolley system would only mean an expenditure of £148,000. The instruction was carried by 86 votes against 72.

Vehicle Builders' Strike Settled.—A settlement has been effected of the strike, which had lasted several weeks, of members of the Amalgamated Society of Railway Vehicle Builders, Wheelwrights, Carpenters, and Mechanics, numbering over 10,000. The employers agreed to withdraw the demand for a 5 per cent. reduction in time work pay, the men accepting a reduction of 15 per cent. on piecework rates. The settlement will result in an average reduction of about 12s. per week per man on piecework. The Lancashire employers refused to withdraw the demand for a reduction of 6s. 3d. per week in time workers' wages, and the strike has consequently been prolonged in that area.

Straker-Squire Omnibuses.—The Progressive Motor Omnibus Company, of Wellingborough, who have already concentrated on Straker-Squire single and double-deck omnibuses, are running services in and about the county of Lincolnshire, where they are opening up several new routes.

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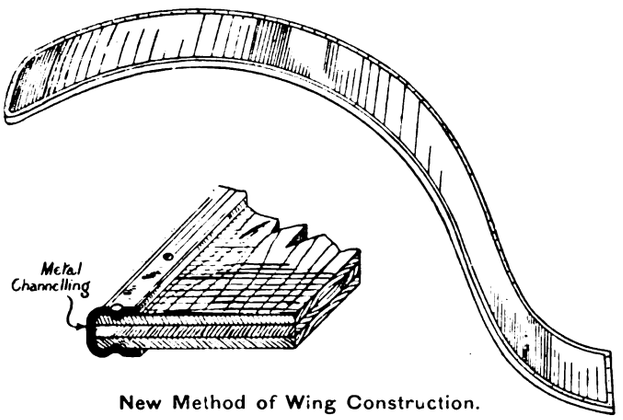
MOTOR TRAFFIC

NEW METHOD OF WING CONSTRUCTION.

Messrs. Strachan and Brown, of High Street, Kensington, a firm of coachbuilders who have been responsible for a number of improvements in the design of motor bodies, have just added to their achievements by introducing a new type of wheel wing which constitutes a radical departure in the construction of this important detail of body work. During their long experience as builders of omnibus and other types of bodies, they have been impressed by the preference shown for wood wings by many users owing to their light weight and point retaining properties in spite of their natural weakness and tendency to split.



New Method of Wing Construction.

The new wing which has been invented by Mr. J. M. Strachan, while retaining the advantages of the old wood wing, entirely does away with its drawbacks. Strength and freedom from splitting is obviated by substituting the best quality waterproof 3-ply for the ordinary solid wood. Additional strength as well as enhanced appearance is obtained by the ingenious device of binding the edges of the wing with metal channelling of U section. This is securely attached by rolling the metal edging on both sides at regular intervals with indentations. Rounded ends to the wings are included, while domed as well as flat wings can be supplied.

These wings are strong, attractive in appearance, and are undoubtedly an improvement upon the easily dented metal type and old-fashioned wood wing. These wings, for which a patent is pending, are supplied to the trade at attractive prices. The firm is well adapted for turning out quantities, and can give quick deliveries of either front or hind wings.

MOTOR VEHICLES FOR MUNICIPALITIES.

Glasgow Health Committee have purchased an additional motor ambulance.

Kent County Council have purchased a used Foden steam wagon for £400, and a light commercial motor.

Middlesex Highways Committee recommend the purchase of a motor car for the engineer at a cost not exceeding £1,200.

Rochdale Cleasing Committee have authorised the purchase of a short wheel-base petrol-driven vehicle for refuse collection.

Calcutta Municipal Council have ordered a Leyland motor gully cleansing machine fitted with appliances for road watering.

Battersea Borough Council have been recommended to purchase two motor vans for use in connection with the disinfecting station.

Newport (Mon.) Corporation have accepted tenders of 5s. an hour for the hire of a motor van and 2s. 6d. an hour for the hire of a horse and man.

Newcastle-on-Tyne.—The Town Improvements and Streets Committee nave recommended the Corporation to replace about 30 hired horse vehicles with mechanically-driven wagons, at an expenditure of £12,000.

Southend Health Committee have decided to make provision in estimates for the provision of two motor vans to be used in connection with the ambulance and disinfecting work, and for motor vehicles for refuse collection.

Sydney (N.S.W.) Municipal Council are recommended by a committee to accept an offer by Leyland Motors, Limited, to supply and fix mechanically operated tipping gear to the Council's 2-ton Leyland lorry for the sum of £245.

Newcastle City Council, who are borrowing £12,000 for the purchase of six heavy and four light motors for refuse collection, and a gully emptying machine, propose to consider the question of the use of machines for the loading of material at the depot.

Hackney Borough Council have purchased a mechanical loading machine from Messrs. Ransomes and Raper, Ipswich. The machine is guaranteed to raise 10 cwt. of clinker from the ground level and deposit it in a Leyland lorry in half a minute, work which will take three men 2·4 minutes.

OMNIBUS SERVICES.

Birkenhead.—The tramways department have acquired three Straker-Squire single-deck omnibuses from Plymouth Corporation Tramways at less than half the original cost of the vehicles when purchased about a year ago. The journey of 305 miles to Birkenhead was made by road. The Corporation have now a fleet of 15 omnibuses, the other types being Leyland single-deck and A.E.C. double-deck. It is intended to increase the services to outlying centres of attraction this summer.

Blackpool.—Blackpool Watch Committee have authorised the chief constable to require motor coaches plying for hire from private premises to be licensed by the committee. The local Motor Coach Owners' Association having asked that coaches should be allowed to stand in public thoroughfares from which the coaches ply for hire, the committee have adhered to their previous decision requiring such vehicles to be run from private premises.

Bradford.—The Watch Committee have given permission to Messrs. G. H. Harris and Son to establish an omnibus service between Horton Grange Road and Marlborough Road. On the recommendation of the Fire Brigade Committee it has been made a condition that all omnibuses shall be provided with and carry fire extinguishing appliances.

Brighton.—Licences have been granted for ten additional omnibuses, on condition that the vehicles are not run in competition with the Corporation tramways.

Chester.—Before issuing a licence to the Crosville Motor Company for a service of omnibuses between Market Square and the city boundary near Stone Bridge, the Watch Committee asked the Improvements Committee to consider whether a mileage charge should be made for the use of the roads. The latter committee decided that a charge of 3d. per car-mile be made in respect of Canal Street and Garden Lane.

China.—Omnibus services are being inaugurated in numerous districts in China.

Colchester.—Complaints have been made that residents in localities not provided with tramways are unable to get home to meals owing to omnibus proprietors being unable to carry short distance passengers, on account of an agreement which protects the tramways service. The Corporation have now partly relaxed the regulation, with the result that one company has started a dinner hour service.

Lancaster.—The Tramways Committee have instructed the Town Clerk to write to the proprietor of the Lambsfield omnibus service protesting against the setting down of passengers within the borough, and also to call the attention of the Watch Committee to the matter. Subject to a satisfactory certificate of mechanical efficiency, the Watch Committee granted permission for an omnibus service to be run between Lancaster, Hallon, Caton and Brookhouse. The Watch Committee have arranged that Dalton Square shall be reserved as an omnibus centre from which omnibuses plying for hire along county roads should start.

Liverpool.—The experimental services of A.E.C. omnibuses run by the tramways department after the theatre performances appear to have met with success. The vehicles serve Sefton Park, Walton, Mossley Hill, Garston and other districts at a single fare of sixpence. In some cases the popularity of the omnibuses is due to the provision of a through service for passengers who otherwise would have to make two or three tramcar changes.

London.—Hampstead Borough Council have sent a strong protest to the Ministry of Transport and to the Commissioner of Police against the proposal of the London General Omnibus Company to run single-deck omnibuses along two roads crossing Hampstead Heath. The Council assert that the proposed service would detract from the amenities of the neighbourhood. On April 2 the L.G.O.C. introduced penny stages on the outer areas of a number of country routes.

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NEWCASTLE-ON-TYNE.—During the three weeks' strike of the tramway employees, motor omnibus services were given on most of the routes by the Northern General Transport Company, the United Automobile Services, Limited, and other owners.

PRESTON.—The Ministry of Transport have sanctioned the raising of a loan of £4,765 for the purchase of motor omnibuses, the loan to be repaid within a period not exceeding six years.

SOUTH SHIELDS.—As a result of the Sunderland-South Shields service of the Northern General Transport Company, the North Eastern Railway Company have withdrawn their omnibuses running between South Shields Station and Horton.

STRETFORD.—Two additional omnibus licences have been granted to the Mid-Cheshire Motor Omnibus Company, on condition that a regular service is maintained to Urmston.

SURREY.—Barnes Urban Council have appointed a committee to interview the Surrey County Council in regard to steps to be taken to obtain some measure of control in the case of roads used as omnibus routes.

MOTOR TRAFFIC NOTES.

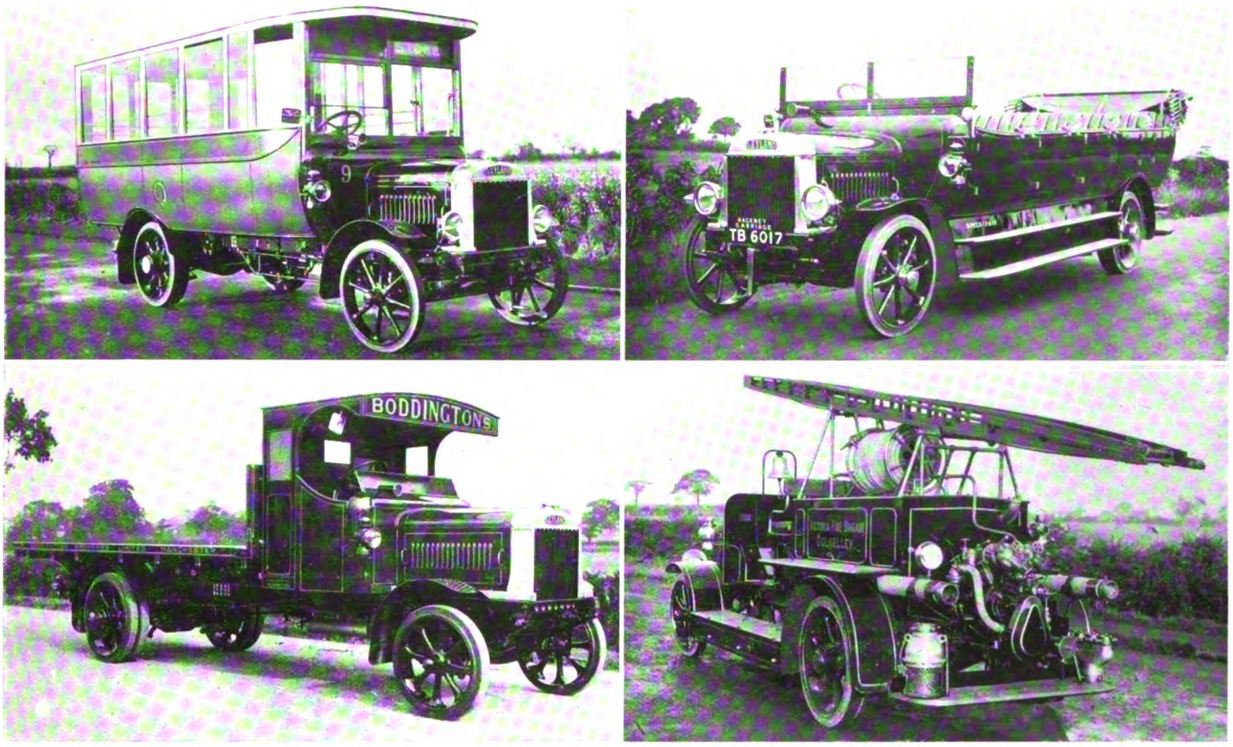
TRAFFIC DIVERSION.—Huddersfield Corporation have arranged to submit a scheme to owners of heavy motor wagons with a view to diverting heavy traffic to suitable roads.

DIVERSION OF HEAVY TRAFFIC.—A scheme has been submitted to the owners of heavy motor wagons by the Huddersfield Corporation for diverting heavy vehicles to suitable roads.

STRIKE AGAINST RAILWAY RATES.—On March 29 the Holland (Lincolnshire) Farmers' Union decided to withdraw farm produce traffic from the railways until the charges are reduced. One farmer has purchased motor lorries.

NEWSPAPER VAN WITH A STENTORPHONE.—One of the *Daily Mail* delivery vans has been fitted with a stentorphone, which gives musical selections, items of news, and excerpts from speeches. The selections can be heard a long way off even in noisy streets.

ISLE OF WIGHT TRAFFIC RIVALRY.—The president of the Isle of Wight Chamber of Commerce considers that if the railways of the island are to meet the competition of the motor coach, improvements must be effected. He suggests that the railways should be electrified.



Recent Examples of Leyland Vehicles.

TORQUAY.—The Tramways Company have for some years been running coaches for short trips and long distance tours. Omnibuses are also in operation, and at the annual meeting of the company on March 30 the chairman stated that the directors had under consideration the advisability of forming a subsidiary company to operate the omnibus undertaking, in view of the considerable expansion in the services which must take place. Shareholders' claims, in that event, would be taken into consideration. Arrangements were being made to extend the services at an early date to Exeter. There was undoubtedly great scope for omnibus services in Devonshire to deal with which the company, with its excellent organisation, was in a favourable position. The motor omnibuses capital account now stood at £45,828, as compared with £16,485, the increased expenditure being represented by additional rolling stock and the new garage. The additional profit in operating omnibuses had been £8,188, compared with £2,582.

WALLASEY.—Wallasey Tramways Committee propose to purchase four additional motor omnibuses from the Liverpool Corporation for £1,700 (£425 each), the cost to be charged to the tramways reserve fund.

LONDON-SOUTHAMPTON TRAFFIC.—During a discussion on the state of the roads at a meeting of the Hampshire County Council it was stated that a large proportion of the heavy motor traffic which arose during the coal miners' strike is being continued between London and Southampton.

MUNICIPAL BOOKING FOR COACH SERVICES.—The local Business Men's Association have asked Bridlington Corporation to again make arrangements for the booking of passengers using the chars-a-bancs travelling from Sheffield to Bridlington during the summer. The Corporation have agreed to do so.

MIDLAND DIVISION, C.M.U.A.—The annual parade of commercial vehicles under the auspices of the Midland Division, Commercial Motor Users' Association, has been fixed for July 8. At the annual meeting it was reported that a breakdown lorry and gang are now available at special rates for members.

TRAFFIC RELIEF IN MANCHESTER.—The Watch and Paving Committees have instructed the city engineer and the chief constable

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to prepare and submit, after conference with the Ministry of Transport, a scheme for the erection of road direction signs for the purpose of diverting heavy traffic from the centre of the city.

Coach Stopping Places at Bradford.—The Licensing Committee have heard the views of a deputation of coach proprietors, and decided to recommend that the facilities for taking up and setting down passengers be restricted to the parts of the city outside a radius of a quarter of a mile from the town hall, with the exception of the authorised omnibus stands.

Inquiries into Road Accidents.—The Ministry of Transport Departmental Committee on Road Vehicles are considering the question of holding official inquiries into accidents on highways. Investigation is recommended particularly in cases in which accidents are alleged to be due to structural defects in roads and vehicles, the object being to ascertain the real cause, with a view to eliminating risks that might otherwise recur.

Ministry of Transport and Alternative Routes.—Recently the Essex County Council applied to the Ministry of Transport for an order prohibiting or restricting motor omnibuses and coaches on two road sections on the ground that the roads were unsuitable for use by vehicles of that class. The Ministry have now requested the County Council to consider the condition of the county as a whole, in order to enable the Ministry to give the broadest consideration to the important questions of alternative routes and the general traffic needs of the county, and to avoid the expense and inconvenience of holding a number of inquiries. The Highways Committee have now considered alternative routes, and propose to include commercial vehicles also, as suggested by the Ministry.

RAILWAYS AND ROAD TRAFFIC BILL.

Second Reading Carried.

On the motion for the second reading of the Railways (North Western and Midland Group) Bill on April 10, Sir W. Joynson Hicks moved the rejection of the Bill. If the Bill were passed the other groups of railways would apply to Parliament for similar powers, and, he asked, what chance road transport companies would have of competing with the huge aggregation of capital of the railways. They would soon be run off the roads. It was true that in 1904-1905 three railway companies got powers to run road traffic, but those powers had not been used to any great extent. Three other railway companies later applied for similar powers, and were refused by the House of Commons. In 1916 there were 600 road transport undertakings; to-day there were 3,000. Their capital was over £100,000,000, and they gave employment to 1,600,000 men. The object of the railway companies was to knock out those undertakings by competition and possess themselves of a monopoly of traffic by rail and road. The rates by road were lower than the rates by rail. He had not the slightest objection to a Royal Commission examining into the proposals. He wished the House to consider whether it was desirable to put the great powers proposed into the hands of the great railway companies.

Mr. G. H. Roberts, in seconding the motion, said that the railways ought to concentrate their resources and enterprise on the development of their legitimate business, viz., the carriage of passengers and goods along steel rails. If they would reduce their rates they would attract a good deal of the traffic that had gone on to the road.

Mr. P. J. Hannan said that the safeguards which the railway companies offered to provide would amply protect the interests of the public, and he contended that the extension of the powers to the railway companies would be entirely to the traders' advantage. The promoters were prepared to embody the safeguard that the revenue and expenditure of the capital investments in railways to their road transport activities must be kept apart from their accounts relating to the railway traffic on rails. They were also willing to insert a clause that the standard charges for the conveyance of the same class of goods by rail and by road should be practically the same.

Mr. Neal, Parliamentary Secretary to the Ministry of Transport, said the Bill raised the whole question of the relationship of the railways to the traffic of the country. He agreed that it would be difficult for Parliament to refuse these powers to any other company that sought them if permission were given for this Bill to become law. The House might be well advised to say that it was the general practice to give a second reading to a Private Bill unless there were paramount considerations of the public policy to the contrary, and to let these matters receive the fullest inquiry by a Committee of the House. In his opinion it would be wise to reject it unless the dangers of monopoly were adequately safeguarded against. In that case then, in the interests of transport and competition, he suggested that the law might well become operative.

Mr. J. H. Thomas strongly supported the Bill. It meant not the setting up but the breaking down of monopoly. He contended that the relations between the companies and the employees were better than ever before, and the efficiency of the railway service was greater. There was more anxiety to do the right thing.

After a long debate the closure was agreed to, and the second reading was carried by 146 votes to 141.

THOMAS TILLING, LIMITED.

Annual Meeting.

Mr. Thomas Tilling, presiding at the 25th annual meeting of Thomas Tilling, Limited, on March 30, said that the company ran its first omnibus 71 years ago this year, viz., in the exhibition year of 1851. They had just replaced a portion of their fleet of motor omnibuses by new and more costly vehicles, with greater carrying capacity, and he hoped he might be excused if he expressed a little pardonable pride in the vehicle they had now evolved. The company now had a direct or indirect interest in twenty-two provincial road transport undertakings. He alluded to the greatly decreasing number of accidents, which had been brought about partly by the increased skill of the motormen and partly by the greater care the public exercised on their own behalf, helped, he had no doubt, by the excellent "Safety First" propaganda. The present system, whereby the whole of the motor omnibuses in London are operated from one controlling centre, had produced surprising results. It had eliminated wasteful competition, and the public had shown their appreciation of the benefits secured by riding in such numbers as the most far-sighted would have considered impossible a short time ago. The earliest horse omnibus carried 24 passengers, and a journey out and home averaged 10 miles. They new carried 48 passengers, and in some cases 54, and journeys of 50 miles were undertaken. A dividend of 15 per cent., less tax, is paid on the ordinary shares for the year 1921, and a sum of £64,148 is carried to special reserve for properties, investments, etc., a balance of £62,257 being carried forward, subject to liability for excess profits duty in respect of the year 1920. Messrs. W. Tilling, R. M. Tilling and J. F. Heaton were re-elected directors.

MR. BARNES' PLEA FOR MORE PRODUCTION.

An able and frankly critical address on "Some Common Fallacies in Trade and Industry" was delivered by Mr. G. N. Barnes, C.H., M.P., at a conference of the Industrial League and Council held in the Caxton Hall, S.W. Mr. H. E. Blain, C.B.E., vice-president of the League, occupied the chair, and paid a warm tribute to Mr. Barnes, who was, he said, universally recognised as possessing honesty of purpose and integrity of aim.

Mr. Barnes declared that the improvement of the conditions under which we live would come with the inauguration of a better social sense, of a better feeling between men and women of all classes; it would never come through malice or class conflict. Some of their friends told them that if higher wages were paid workmen would be able to buy and everybody would be employed. But the problem was not so easy as that. The critics of the present system forgot that the British workman did not consume the products he turned out, except a very small proportion of them. Our troubles arose therefore from the fact that we had to produce for people overseas—at a price—or if we could not, then other countries would cut us out. A larger unit of production per head on the part of British workmen and a greater effort to attract the foreign buyer would do more to lessen unemployment than anything else he knew. It was not so much wages that were at the bottom of industrial disputes; in the era through which we were passing, when machinery played an increasingly important part, the paramount necessity was to get the greatest output from that machinery. One of the main things we must do was to get this into the heads of the workman, and he would soon find that a few shillings per week on his wages would be regarded by his employer as comparatively unimportant. Employers and workmen must resolve to get the best out of the present industrial system by friendly contact in a spirit of co-operation and good will, though the Government might help by reducing taxation to the lowest possible limit.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, MAY 18, 1922. VOL. LI.

LIVERPOOL CORPORATION TRAMWAYS.

THE NEW LAYOUT AT THE PIERHEAD TERMINUS.

The layout of the new Pierhead terminus of Liverpool Corporation Tramways affords a peculiarly successful solution of the traffic problem at this important and busy centre of the city's chief transport undertaking. In a town situated as is Liverpool in relation to the Mersey, it will be readily appreciated that the waterside forms one of the key points of the tramway system. A large proportion of the business population either live across the river in Cheshire or have frequent occasion to cross the waterway in the course of their work. The Liverpool tramway system therefore takes the form to some degree of an open fan, with the Pierhead as the centre, the majority of the routes radiating to the various suburbs. There are, however, several intersecting routes cutting across and linking up these radial lines. The effect of this configuration would be, in the absence of some carefully devised scheme, to create at the Pierhead a most undesirable congestion, as the amount of loading and unloading, especially at rush hours, is considerable.

By the courtesy of Mr. J. A. Brodie, M.Eng., P.P.Inst.C.E., the city engineer, we are able to reproduce photographs showing the layout of the new Pierhead terminus. It rarely happens that a tramway authority has an opportunity entirely to re-plan and extend its central terminus, and the committee, the city engineer, and the general manager (Mr. P. Priestly, M.I.E.E.) of the Liverpool Corporation Tramways are to be congratulated upon having taken the fullest advantage of the facilities afforded by the reconstruction works which have followed the abolition of certain obsolete docks. In the details of the layout shown in Fig. 1, the bold and original treatment which one is accustomed to associate with Mr. Brodie's designs is apparent. The layout consists of three large "balloon" loops with extensive standby accommodation, and represents the solution reached after prolonged consideration of the tramway traffic problem at the Pierhead. The three loops divide the traffic as it arrives from the outlying districts, and the two parallel lengths of track running the full length of the Pierhead frontage provide a loading space in excess of the present requirements. The loops are so connected that in the event of a breakdown on any one of them the traffic can immediately be diverted to the others. All the cars are thus enabled to return

The New Pierhead Terminus of Liverpool Corporation Tramways—View Looking towards the Mersey.

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by the route on which they arrived. For example, cars arriving at the Pierhead by Water Street can traverse Loop No. 2 and set out on the outward journey along the same street. The advantage of the three loops becomes clear when it is recollected that on the old layout the majority of the cars used one central loop, with its very limited loading frontage, and that the normal traffic at this terminus is approximately 3,000 cars per day. The new terminus was put into service in March 1921, and the accompanying illustrations show the lay-out. Two of the photographs were taken from the top of the Cunard building.

[Central Aerophoto Co.

THE LIVER BUILDING. CUNARD BUILDING. MERSEY HARBOUR BOARD BUILDING.

Liverpool Tramway Terminus at the Pierhead—View taken from an Aeroplane over the Mersey.

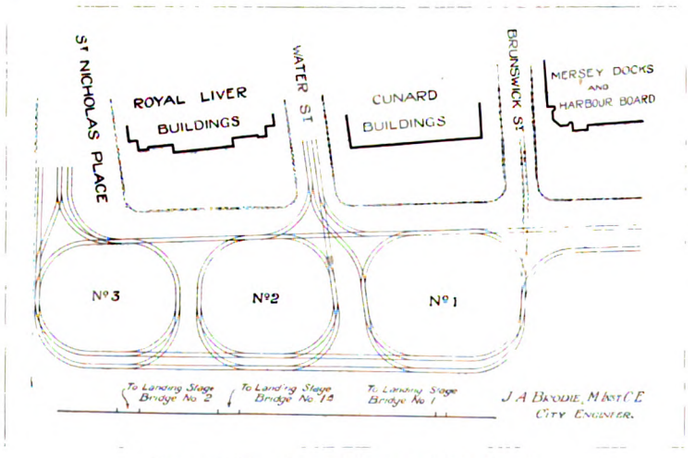
At present the traffic arrangements for the loops are as follows—

No. 1.—Smithdown Road, Wavertree, Calderstones, and Garston cars.

No. 2.—Prescot, Old Swan, Knotty Ash, West Derby, Green Lane, Edge Lane and Bowring Park cars.

No. 3.—Walton, Aintree, Fazakerley, Everton, Litherland, Seaforth, Cabbage Hall, Clubmoor and Croxteth cars.

Each loop is provided with an illuminated destination indicator, which can be seen in the illustrations.



Plan of Tracks at Liverpool Pierhead.

Designs for shelters and queue arrangements are under consideration.

Manganese steel points have been used throughout the work, and the whole of the curved rails are of standard quality silicon steel, treated by the Sandberg "Insitu" rail hardening process. Before the application of the "Insitu" treatment the rate of wear on the curved rails (maximum radius 60 ft.) was very high, but we understand that this treatment has been successful in arresting the wear to such an extent that its cost has already been justified. At one time the entrance to Liverpool from the river was anything but pleasing; to-day, with the opening of new approaches to Chapel Street, Water Street and James Street, the erection of the imposing buildings of the Mersey Docks and Harbour Board, the Royal Liver Insurance Company and the Cunard Steamship Company, together with the arrangement of the tramway terminus around sunk gardens, the prospect is most attractive and dignified, and is certainly not excelled in any other commercial city either at home or abroad.

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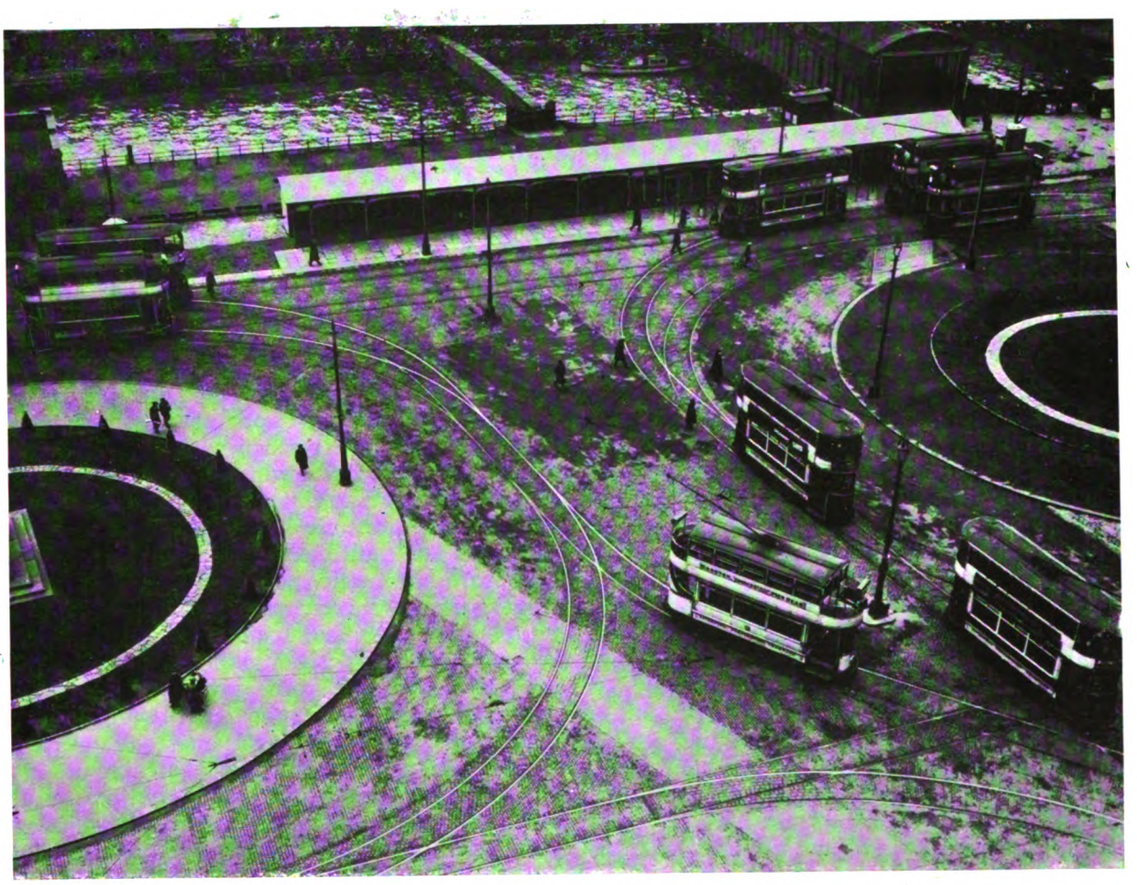
Loops Nos. 2 and 3—Liverpool Tramway Terminus at the Pierhead—View taken from the Cunard Building.



Arrangement of Tracks between Loops Nos. 2 and 3—Liverpool Tramway Terminus at the Pierhead.

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THREE-COACH ELECTRIC TRAINS OF THE LONDON AND NORTH WESTERN RAILWAY.

The extensive electrification work carried out in recent years by the London and North Western Railway Company on their suburban lines represents a very important advance in the gradual process of conversion to electric traction of the London suburban railway communications. The lines in question are operated with direct current at 630 volts, the current being collected from third and fourth rail. As traffic unit, a train composed of one motor coach, one trailer coach, and one driving trailer coach has been adopted; two of these traffic units can be coupled together, when required.

It is proposed, in this article, to describe these three-coach electric trains, which present several new and interesting features. The motor coaches for these trains are each equipped with four motors having each a one-hour rating of 250 H.P.; the motors are geared to the axles and suspended in the usual way with rubber compression pads between suspension lugs and the transom. A train speed of 44 miles per hour can be attained with drawbar pulls reaching 21,000 lbs. Multiple control is provided from any driver's cab.

In 1913 the London and North Western Railway Company placed its first contract for electrically operated three-coach trains for their suburban lines, Euston-Watford, Broad Street-Watford, Broad Street-Kew Bridge, and Broad Street-Richmond. Underframes, bogies and coach bodies for the 43 motor coaches under this contract were manufactured by the Metropolitan Carriage, Wagon and Finance Company, Limited, Saltley, Birmingham, while those of the 38 trailers and 38 driving trailers for coupling to them were constructed at the carriage works of the London and North Western Railway at Wolverton.

The electrical equipments for these coaches were ordered from the Oerlikon Company, of Oerlikon, Switzerland, through the representative of the firm, Mr. G. Wüthrich, M.I.E.E., now general manager and chief engineer of Messrs. Oerlikon, Limited, of 34-35 Norfolk Street, London, W.C2. An additional order was placed with them in 1915 for the electrical equipments of a further 30 three-coach trains and three spare motor coaches. These two contracts, covering in all 76 motor coaches, 68 trailers, and 68 driving trailers, were executed under very difficult conditions, as manufacture and erection were carried out, to a great extent, during the war.

Owing to the many conditions imposed by heavy suburban traffic, it was necessary to go into the whole question of electrical equipment very thoroughly. In the case of motor as well as of apparatus, special design was adopted, which, in many ways, departed considerably from standard practice; all these modifications proved, however, entirely satisfactory. It may also be added that the Oerlikon Company evolved a new system of multiple control for these coaches.

The first train units under the original contract were already in service in 1915, and gave excellent results. Owing to the exigencies of the war, the manufacture of the underframes, bogies, etc., and the coach bodies under the second contract had to be suspended until the end of the war. The material under this contract has now been delivered and stored at Saltley and Wolverton, and the equipments are in course of erection.

A brief summary of the very exhaustive and complete specification issued by Lieut.-Colonel F. A. Cortez-Leigh, T.D., R.E., chief electrical engineer of the London and North Western Railway is given below.

Three-Coach Electric Train, 1000 h.p., of London and North Western Railway with Oerlikon Equipment.

Specification of Trains and Main Data.

The traffic unit is a three-coach train, consisting of a motor coach with apparatus compartment and driver's cab, a trailer coach without driver's cab, and a driving trailer coach with driver's cab. These must be so arranged that two such three-coach trains can be coupled together and operated by means of multiple control. The multiple control is to be non-automatic as well as automatic, i.e., the driver is to be able, at will, to operate the controller for all the starting notches or to put the control handle immediately on to the requisite running position; the whole starting process is, in the latter case, to be governed by a relay, which operates when the motor current drops to a predetermined value after each successive current rush, and thus controls the automatic notching up. Furthermore, the electrical equipment of the three-coach train is to be arranged in two completely independent halves, so that one or the other half can easily be cut out when desired. Each motor coach is provided with four motors, two motors being mounted on each bogie.

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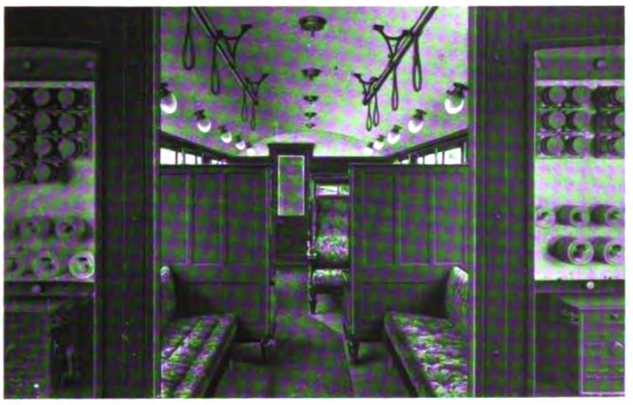


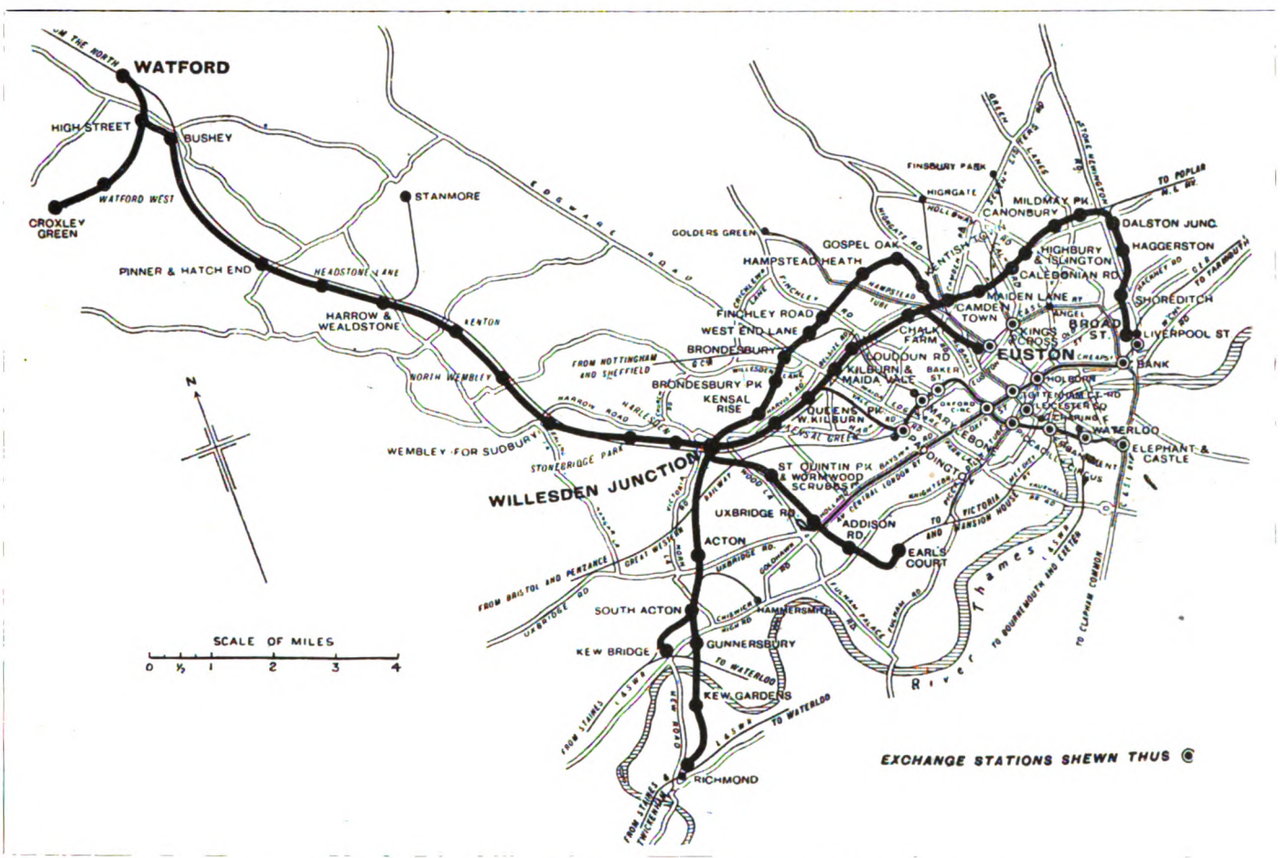
First-class Compartment in Trailer Coach.

Average running speed	25 miles per hour.
Maximum running speed, about	40 miles per hour.
One hour rating measured at wheel rim ...	1,000 H.P.
Drawbar pull measured at wheel rim ...	14,000 lb.
Maximum drawbar pull	21,000 lb.
Average acceleration when starting ...	1·2 miles per hour per sec.
Average pressure	575 volts.
Gauge	4 ft. 8½ in.
Diameter of driving wheel	3 ft. 7⅝ in.
Weight of three-coach train (empty) ...	112 tons.
Mechanical part	92 tons.

Electrical equipment consisting of—

Motors.	Switchboard.
Contactors.	Contact shoes.
Circuit breakers.	Controllers.
Reversers.	Main fuses.
Starting resistances.	Lighting and heating equipments.
Couplers and sockets.	Cables, conduit, and various erection material.
Relays.	

Approximately ... ... 19·7 tons.



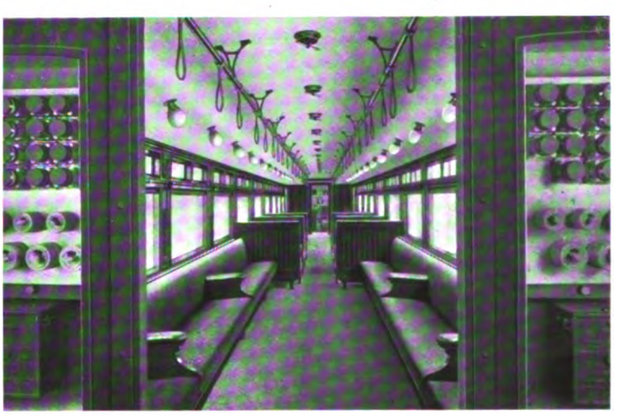
Map of Electrified System of L. & N. W. Railway in London and Suburbs.

To determine the capacity of motors, calculations were based upon the profile of the various lines to be electrified and the speed diagrams for the different gradients. The estimated weight of each train was 112 tons, including 12 tons for passenger load and 16 tons for electrical equipment. It was, however, necessary when fixing capacity of motors to take into account the fact that the weight of electrical equipment might exceed the value assumed. After completion it was found that the weight of train and equipment, exclusive of passengers, amounted to 112 tons.

The figure obtained from calculations for one hour rating of motors was 225 H.P. measured at wheel rim.

The motors supplied are, however, capable of developing 250 H.P. at wheel rim, on one hour service.

The principal data of the complete three-coach trains are as follows—



Third-class Compartment in Driving Trailer Coach.

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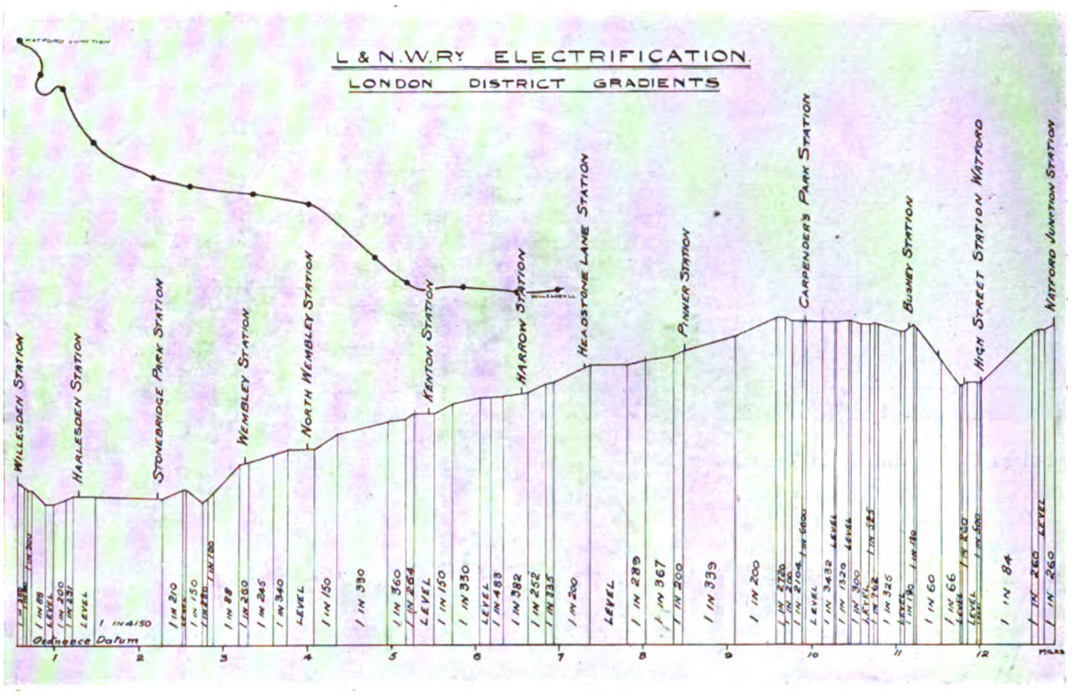


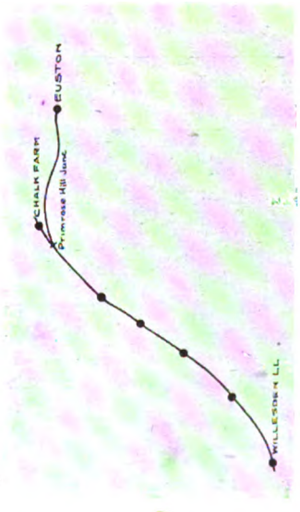
Profile of Section Willesden Station—Watford Junction Station, with Plan.

Coach Design and Mechanical Parts.

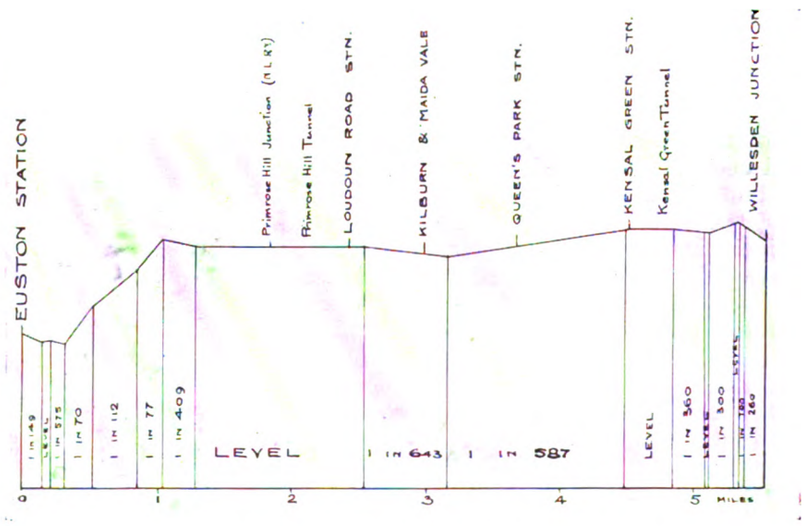
The motor coach is provided with two two-axle bogies and a driver's cab at one end only; adjoining the latter is the apparatus cabin, the sides of which are provided with louvres for ventilation purposes. A small luggage compartment is arranged between the passenger compartment and the apparatus cabin, doors being provided to enable the train staff to pass through the train. The trailer, without driver's cab, is also mounted on two two-axle bogies and has one third-class and two first-class compartments; the interior of the coaches is carefully finished off, and the dimensions are ample. The driving trailer, with driver's cab, is at the end of the three-coach train; it is carried, as in the case of the other coaches, by two two-axle bogies. This coach is wholly reserved for third-class passengers, and constitutes one large compartment.

The seating accommodation in all compartments of the three-coach train is arranged both lengthways and transversely. All coaches are fitted with standard Westinghouse air brakes, motor coaches and driving trailers being provided with hand brake as well.

The lighting and heating of the coaches is electric throughout, and current for these purposes is taken and mainly controlled from the motor coach. Small marble switch panels are fitted in each car vestibule, whereby any series of five lamps or set of heaters can be turned on or off. Two single-pole switches are fitted in the luggage compartment of the motor coach, each controlling half the lighting and heating of the three-coach train, so that the guard can turn on or off the whole train lighting from one position, provided the local switches mentioned above are on. A single-pole switch is also fitted in the vestibule of each driving-trailer coach, so that the guard can control half the lighting from that end of the train when necessary.



Plan of Section Euston Station —Willesden Junction.



Profile of Section Euston Station—Willesden Junction.

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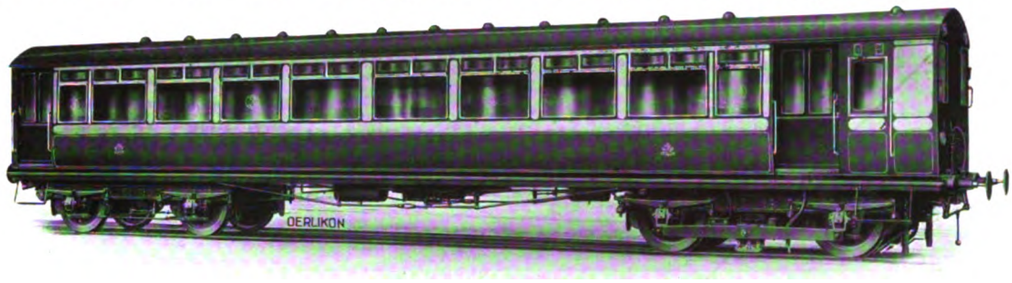
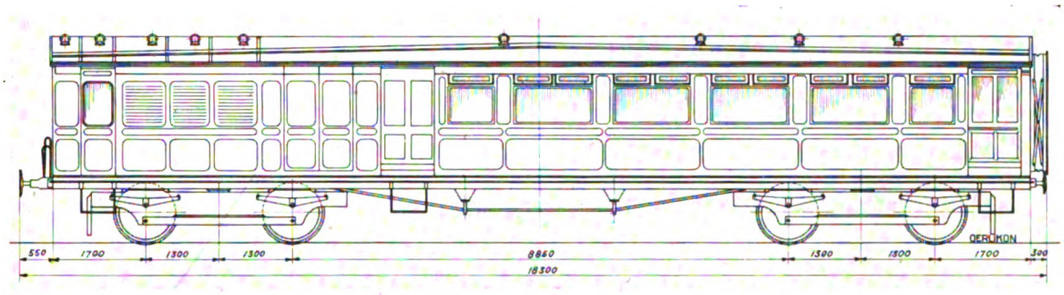
As previously mentioned, two three-coach trains can be coupled together so as to form one train and controlled jointly from one driver's cab, if traffic requirements necessitate this. When this train composition is adopted, the motor coaches are usually coupled at the extreme ends of the train.



Driving Trailer with Driver's Cab.

ELECTRICAL EQUIPMENT AND COLLECTING GEAR.

The whole electrical apparatus is fitted on motor coach. The diagram of connections given here refers to motor coach equipment only; furthermore, lighting, heating, and air compressor are not shown on it. The middle coach, or trailer, merely carries the busline cables for the main current, the control leads and the cables for compressor, lighting and heating; all these connections are run through the underframe of the coach. The motor and the driving trailer coaches at the ends of the train are fitted with complete control equipments. The third and fourth rail system has been adopted for collecting the current. The negative contact rail is arranged in the centre between the running rails, and the positive contact rail is placed outside the track with its centre 16 inches from gauge line; the current is collected from positive rail by means of sliding contact shoes, pressed down on rail by their own weight and suspended from cast-steel brackets; these brackets are bolted to oak shoe beams, carried on the axle boxes of the bogies. The contact shoes on the driving trailers are suspended from brackets in a similar way; these brackets are also supported by oak shoe beams. The negative shoe on the motor coaches is carried by a short oak beam fixed to a bracket attached to the motor casing. Both bogies on the motor coach, as well as the end bogie of the driving trailer (immediately beneath the driver's cab) are fitted with contact shoes. All contact shoes are connected to the main busline cables, and are individually protected by contact shoe fuses. The main cables are connected to the main knife switch on the switchboard in the driver's cab, so that the whole electrical equipment can be isolated by means of this main switch.



Outline Drawing of Motor Coach.

Motor Coach of Three-coach Train with One Hour Rating of 1000 h.p.

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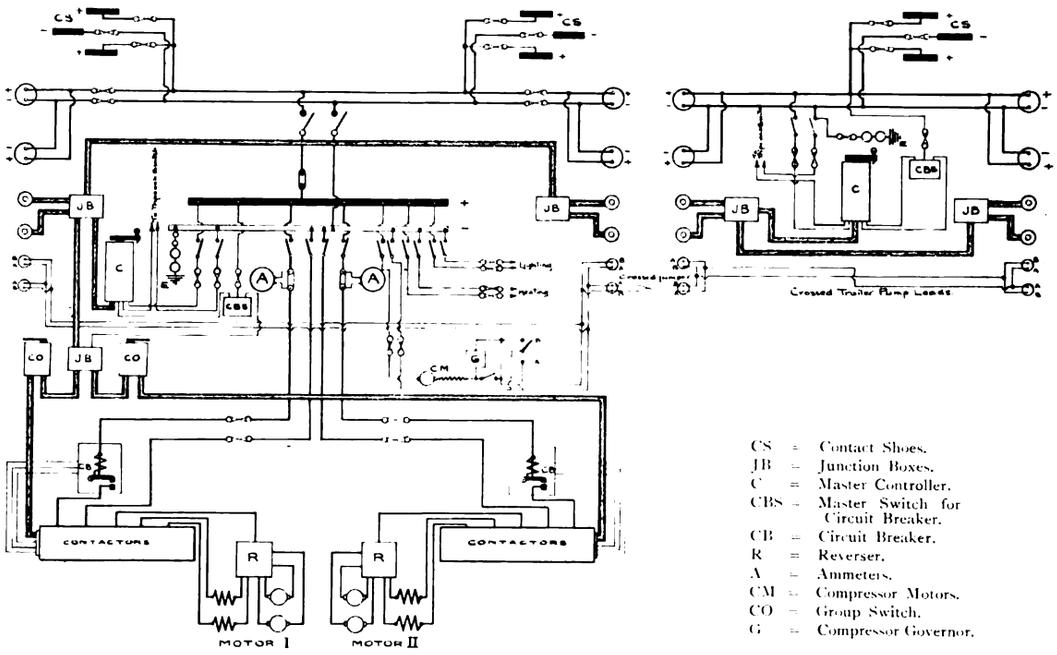


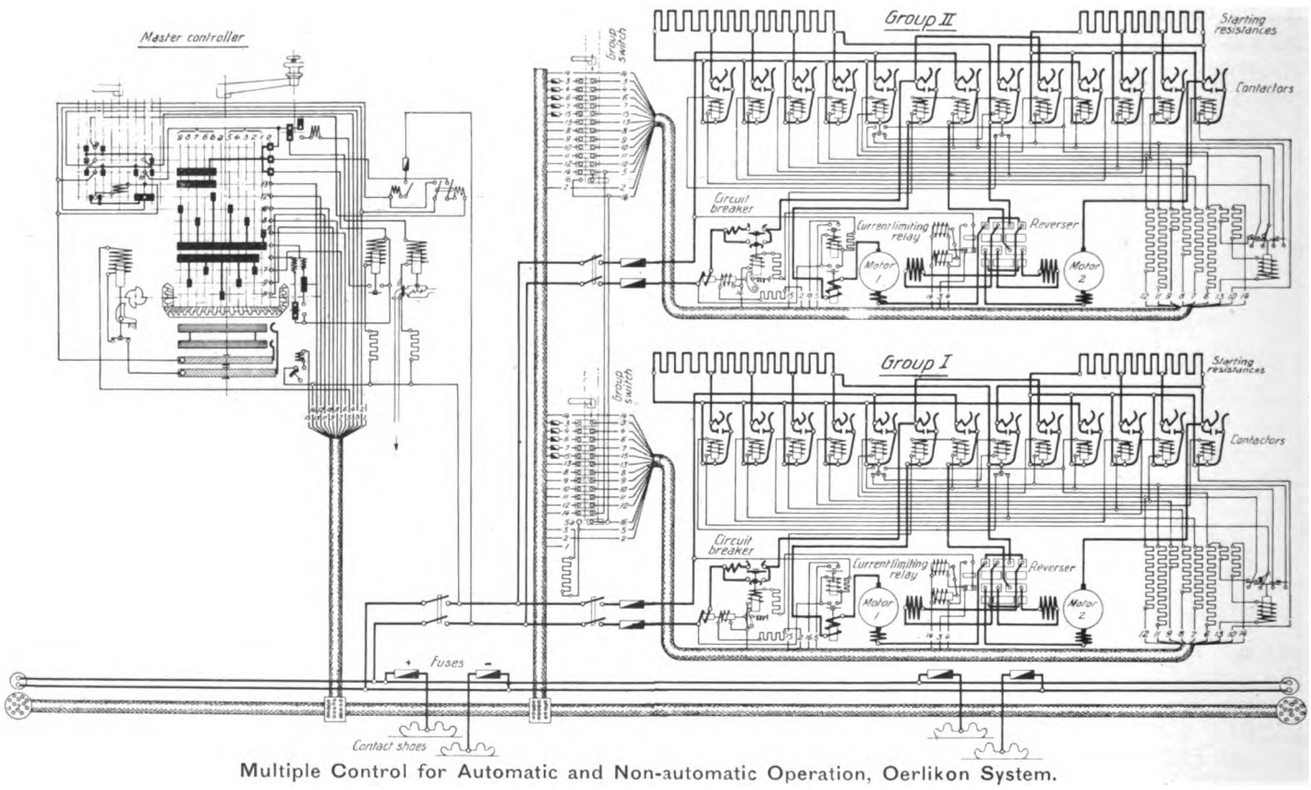
Simplified Diagram of Connections.

From the main switch the current is led to the two switches of the two groups of equipments. The control leads of the two groups pass through a multiple group switch; with this arrangement any control circuit can be cut off at will.

Traction Motors.

The motors have, as already stated, an hourly rating of 250 B.H.P. measured at the wheel rim. All motors were tested on the test bed of the Oerlikon Company, either by the London and North Western Railway Company's representative or by an expert nominated by them; the following trials were carried out—

(1) Measurement of temperature rise during and after one hour's run.
(2) Overspeed test at motor speed corresponding to train speed of 56 miles per hour.
(3) Checking of the characteristics by running the machine in both directions.
(4) Insulation tests with 2,000 volts A.C. hot.
(5) General insulation tests.



Multiple Control for Automatic and Non-automatic Operation, Oerlikon System.

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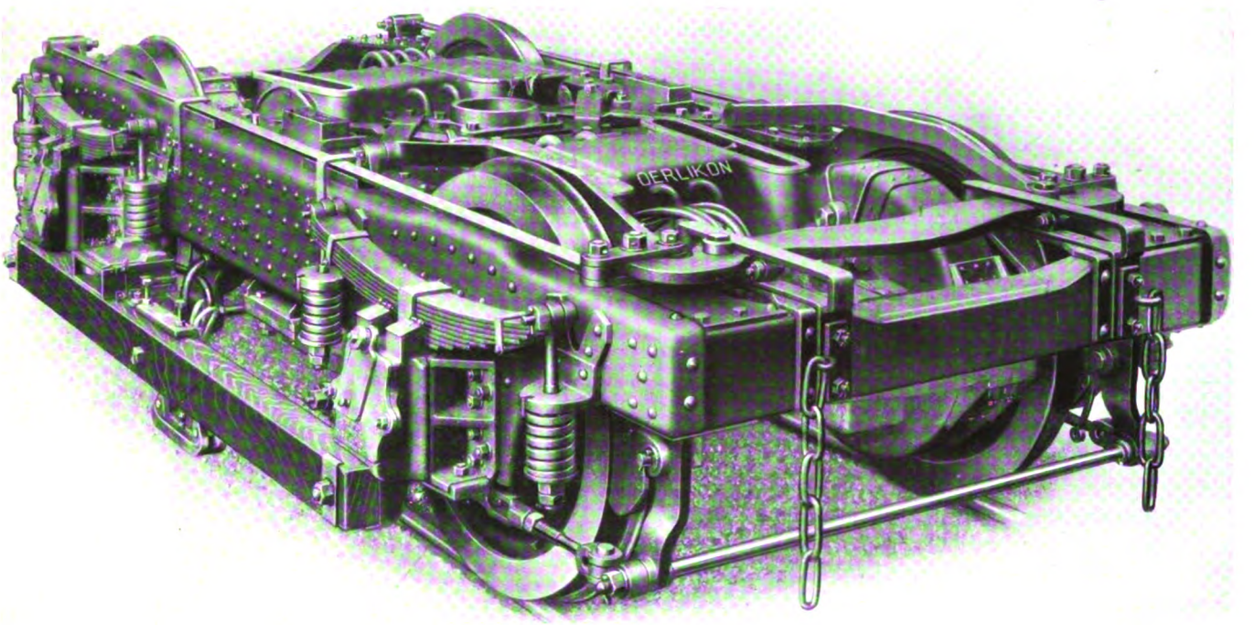
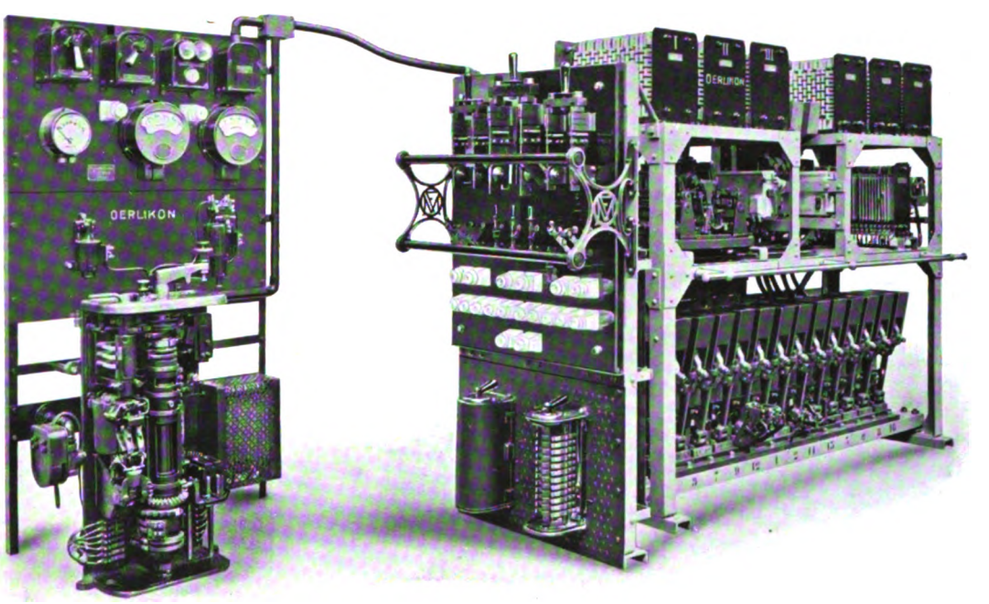
Motors picked out at random were subjected to efficiency trials, and to a load test with 140 B.H.P. and 400 volts.

The motors are totally enclosed and self-ventilated by means of fan bolted to commutator end-plate. The cooling air for the motors may be taken by means of flexible pipe connection from a duct communicating with exterior at a point of underframe where the air is comparatively pure and free from track or brake dust. At present, however, the intake openings are blanked off as the motors are so amply dimensioned that they do not exceed the guaranteed temperature rise in service. The motors are supported on one side by bearings on driving axles; on the other side the motors are fitted with noses held between compressed rubber blocks attached to the transom. The gearing has a ratio of 1 to 3·3. Both gear wheel and pinion are made of tempered tool steel; the gear wheel is in one piece and pressed on to the axle. The gearing is running very quietly and giving entire satisfaction.



Bogie of Motor Coach with Motors in Position.

The motors when developing 250 B.H.P.—their one-hour rating—and with a supply pressure of 575 volts, have a speed of 620 revolutions per minute, and an efficiency of 87 per cent., including losses in gearing. The maximum speed is 1,400 revolutions per minute. A special feature of the motors is the yoke carrying the brush holders, which is of cast steel; mica insulation is used throughout. The armature of motors is bar-wound



Control Equipment Erected in Test Room.

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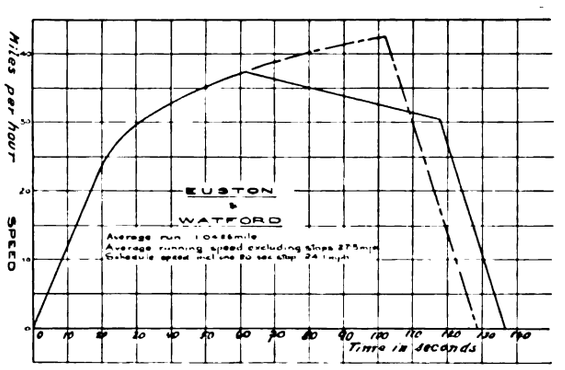
and the conductors are mica insulated in the slots. The field and auxiliary pole coils are built up of copper strip. Perfect commutation is obtained with these machines. It may be of interest to mention here that a motor of this type wound for a pressure of 2,400 volts has given, on test, 250 B.H.P. on one-hour service and developed continuously 150 B.H.P.; this machine has also dealt with the overloads stipulated without flashing over or sparking.



Starting Diagram (Euston and Watford).

The following are a few particulars regarding the motors for the London and North Western Railway equipments—

Diameter of armature	18·9 in.
Width of core	12·6 in.
Number of slots	53
Number of commutator segments ...	159
Diameter of commutator	16·9 in.
Number of brush holders	2
Number of brushes per holder ...	4
Weight without gearing	6,600 lb.

Control Gear.

For starting up and regulation, 13 contactors are provided for each two motor groups; these contactors are fitted with main and arcing contacts with magnetic blow-outs. They are electro-magnetically operated, very simple in design and very strong in construction; the wear of these contactors has proved to be very small. Built for 400 amps. at 360 to 630 volts, they are capable of breaking double their normal current without difficulty.

The circuit breakers have a double break and are provided with magnetic blow-out; they are operated electro-magnetically and are fitted with adjustable overload releases. Two main fuses are provided in addition to the circuit breakers for protecting the motors, each motor group having one circuit breaker and two fuses. If necessary the circuit breakers can also be operated by hand.

Each of the two groups is provided with an electrically operated reverser; the latter is interlocked with circuit breaker in such a way that the breaker of any group can only be closed when the corresponding reverser is in the position indicated by reversing key on the master controller. The starting resistances are built up of substantial cast-iron elements of special design; they are carried by mica insulated steel bolts, fitted in iron frames.

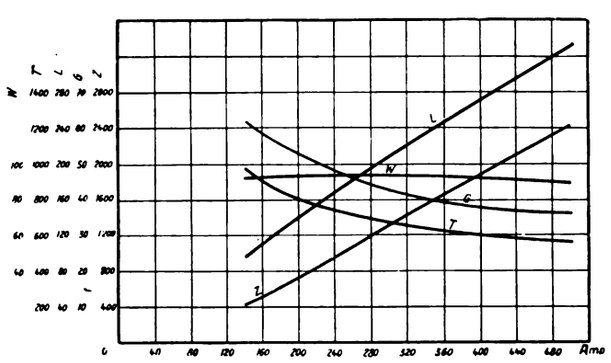
The motor and contact shoe fuses consist of copper strips which can easily be replaced; they are held in suitable clamps mounted in oak fuse boxes, the latter being lined with fire-proof material, and iron bound in such a manner as to secure a proper blow-out effect.

The controller is designed, as previously stated, for automatic as well as non-automatic operation. It is provided with a "dead man's" handle, so arranged that, during operation, the driver has to depress by hand a push button fitted in the controller handle. As soon as the push button is released, the control circuit of the contactors is broken and the brake relay actuates the air brake. Nine starting steps are provided, five for series connections and four for parallel connections of motors, the fifth and ninth steps respectively being running positions. The change-over from series to parallel connections of motors is effected, without break, by means of the bridging connections.

Automatic Operation.

During automatic operation of the motor-coaches, the controller spindle and drum move independently, the latter being actuated by a ratchet magnet; if the position of controller handle and drum coincide, the circuit of ratchet magnet is open; when, however, a relative angular displacement occurs, owing to the controller being moved to a given position, the circuit of ratchet magnet is closed and the ratchet gear causes stepwise motion of drum until the latter reaches position corresponding to that of controller handle. The opening and closing of ratchet magnet circuit is effected by means of two contact fingers which are fitted to carrier at lower end of controller spindle and slide on contact segments mounted on drum; connection between contact fingers and ratchet gear is ensured by two contact rings carried by controller spindle and contacts on stationary portion of controller. When the motor is reversed, the drum is carried back with it by means of an interlocking notch.

A current limiting relay is inserted in the circuit of the ratchet apparatus so that forward motion of the controller drum is only possible when the motor current does not exceed a certain value, previously fixed. The driver can therefore set his controller handle immediately in the desired running position; the ratchet apparatus will then cause the drum to



Characteristics of Motor.

W = Efficiency per cent.
G = Speed k.m. per hour.
L = Output in horse power.
Z = Tractive effort in k.g.
T = Revolutions per minute.
Tractive effort and output are measured at wheel rim.

revolve, the speed being regulated by the current-limiting relay.

The controller drum is provided with the necessary contact segments for bringing into play the number of contactors corresponding to each speed step. When the

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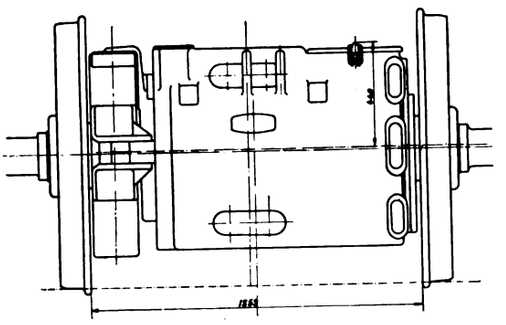
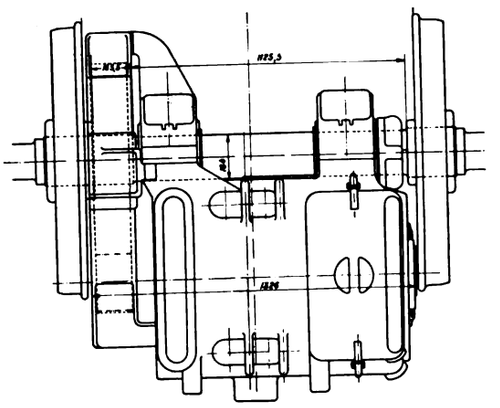
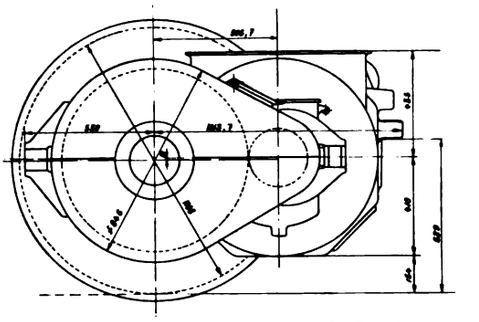
controller is not required to operate automatically, the controller drum is coupled to the controller handle by means of a simple clutch actuated by a knob on the top plate of controller; the latter operates then as an ordinary controller; the automatic gear is, in this case, cut out and does not interfere in any way with the non-





automatic operation of controller. Electrical interlocking contacts are fitted on two contactors only; there are, in addition to these, mechanical interlocks on three of the most important contactors. This interlocking gear ensures very effectively the correct operation of the contactors under all conditions of service and removes the possibility of short-circuits or current rushes occurring owing to the contactors "sticking in." The arrangement adopted permits of a considerable reduction in the number of electrical connections and has been found to satisfy entirely the conditions specified. This simple design of contactor gear has proved wholly successful, and given excellent results during the many years it has now been in use.

The operating coils of contactors are in series for any position of controller. In order to keep the value of



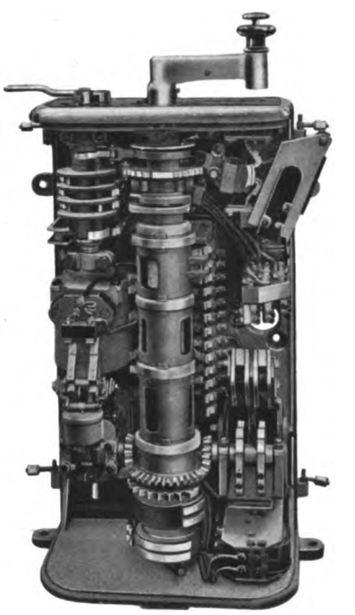
Outline of Oerlikon Motor with Gearing.

resistance constant for every controller position, the operating coils cut out are replaced by resistances in series. The control circuit of contactors is arranged so that no interruption of current takes place when passing from one position to the next. Furthermore, no arcing can occur between the fingers and the contact segments of controller, as the circuit is broken in a central blow-out; in view of this the wear of fingers and contact segments is very slight, even after several years' service. The central blow-out gear is operated by the controller drum through bevel gear, and the current is interrupted in a powerful magnetic field.

For changing over from series to parallel connection, a relay is provided which permits of the utilisation of the same control leads for both control positions; in this way four control wires can be dispensed with.

Contactor, 400 amps., 630 volts, with upturned arc chute.

Main Circuit Breaker, 800 amps., 630 volts, with upturned arc chute.



Master Controller for Automatic and Non-automatic Multiple Control.

All cables are placed in seamless steel tubes, and joints are made in cast-iron junction boxes, except in the case where the wires are connected to apparatus.

The weight of the electrical equipment which, as stated before, amounts to about 20 tons, is made up as follows—

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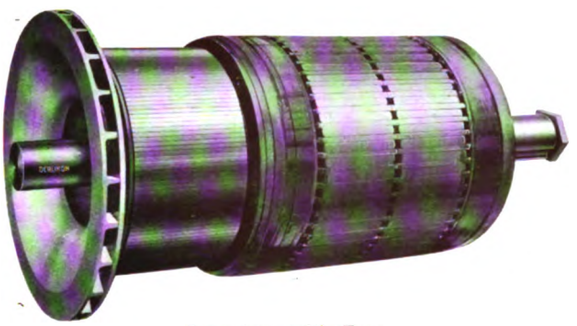
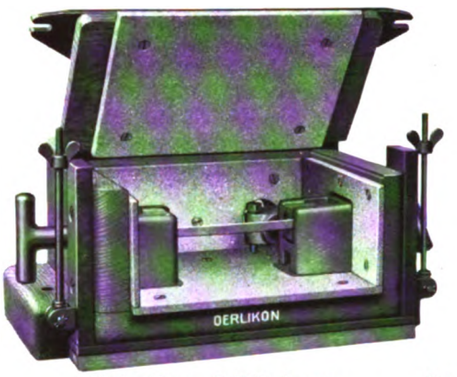
Detailed Weights of Electrical Equipment.

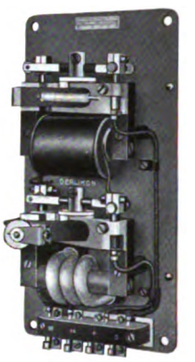
4	Motors, including gearing	28,600 lb.
26	Contactors	3,300 ,,
2	Circuit breakers	374 ,,
40	Couplers for busline and control leads, also for compressor and lighting connections ...	1,100 ,,
6	Relays (2 series-parallel, 2 brake, 2 no-volt)	132 ,,
3	Switchboards	440 ,,
2	Reversers	550 ,,
9	Sets of contact shoe collecting gear ...	1,320 ,,
2	Controllers	880 ,,
13	Main fuses	660 ,,
2	Group switches	88 ,,
2	Current limiting relays	44 ,,
2	Sets of starting and regulating resistances ...	1,980 ,,
2	Sets of control resistances	154 ,,
4	Control and heating switches	44 ,,
	Lighting and erection material	4,334 ,,
		44,000 ,,



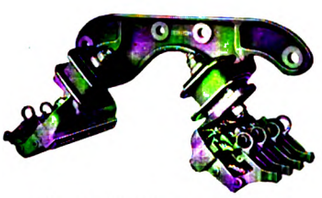
Armature with Fan.

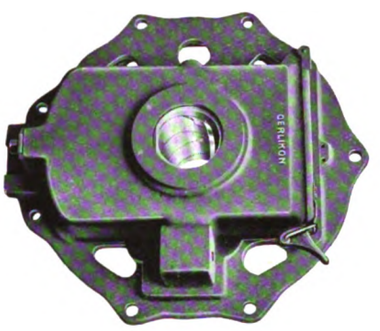


Main Fuse, 2,000 Amps., 630 Volts.

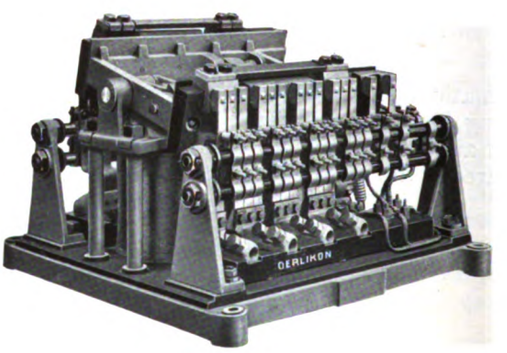


Current Limiting Relay with Cover Removed.





Brush Holders with End Bearing Shield.



Reverser.

Performance at Tests.

All train units have been tested on the Willesden-Watford line, or on other sections of the system. Average figures, taken from the acceptance certificates of the train units 30 E to 47 E, for about twenty trial runs, including starts, are given below; the length of run was 12·252 miles with eleven stops of 20 seconds each. The average distance between stops was 1·114 miles.

Guaranteed figures, as well as average values based upon the figures in the above table are given below in order to permit of comparison.

	Average values obtained at tests	Guarantee figures
Starting acceleration	1·4 miles per hour/sec. 0·63 metres/sec².	1·2 miles per hour/sec. 0·535 metres/sec².
Energy consumption	64·9 watt-hours per ton-miles	66 watt-hours per ton-miles
Maximum motor current when starting	417 amps.	500 amps.

Owing to the good acceleration obtained, the condition stipulating that a speed of 24 miles per hour was to be reached, when starting, within 20 seconds, could be easily satisfied.

The temperature rise of the motors and starting resistances, in continuous service, proved also to be very low. After a 17 hours' normal service on the Earl's Court-Willesden line, the following maximum

No. Train		Train Composition	Starting Acceleration: Miles per hour per second	Starting Acceleration: Metres per sec.²	Starting Acceleration: Per ton-mile	Energy Consumption in watt-hours: Per ton kilometre	Maximum current per motor amps.
30 E	33 E	6 coach	1·44	0·63	66·8	42·3	400
	31 E	3 ,,	1·45	0·65	75·2	47·5	410
32 E	34 E	6 ,,	1·54	0·68	70·4	43·7	420
35 E	36 E	6 ,,	1·31	0·59	68·5	42·5	400
37 E	38 E	6 ,,	1·38	0·62	64·0	39·8	420
39 E	40 E	6 ,,	1·40	0·63	64·1	39·8	420
41 E	42 E	6 ,,	1·39	0·62	57·0	35·5	420
43 E	44 E	6 ,,	1·46	0·65	61·7	38·4	440
45 E	46 E	6 ,,	1·36	0·61	48·9	31·0	420
	47 E	3 ,,	1·40	0·63	68·1	42·5	420

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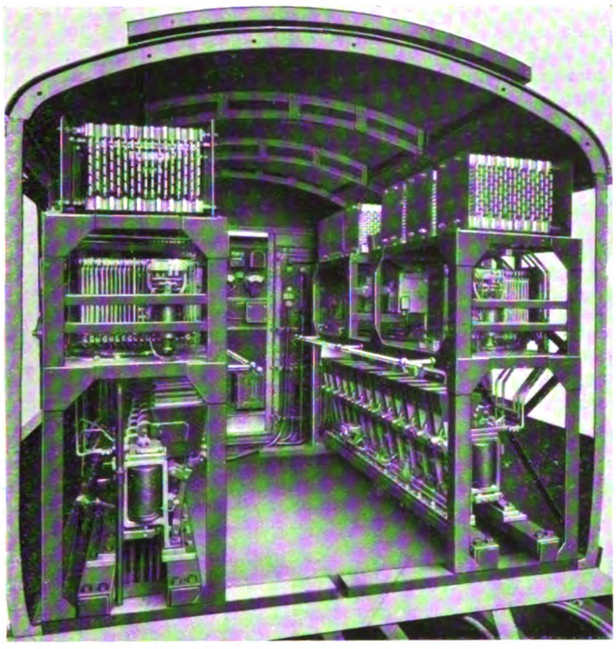
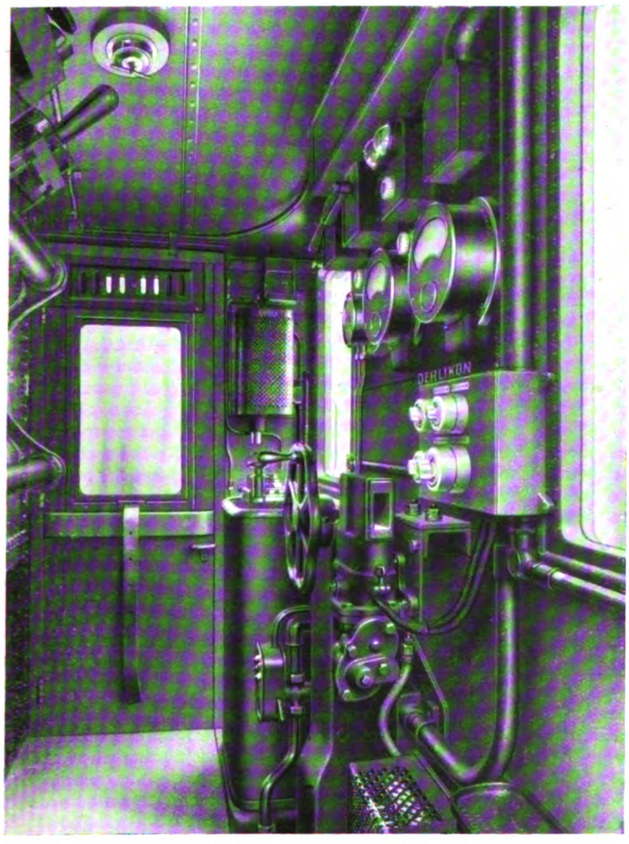
temperatures were measured with an atmospheric temperature of 24° C.—Commutator copper, 70° C.; armature core, 75° C.; starting resistances, 160° C. (cast iron).

In conclusion, it can be said that the excellent



View of Apparatus Cabin during Erection.



Driver's Cab in Motor Coach.

results obtained throughout the period of nearly six years during which the motor coaches have now been in service have fully demonstrated the soundness of the design and construction of the equipments.

RAILWAY ELECTRIFICATION AND SAFETY

LIMITS OF VOLTAGES NEAR THE GROUND.

In a recent lecture on "Electric Traction" at the London County Council's School of Engineering and Navigation, Mr. Theodore Stevens dealt with the risks involved in high voltages in conductors near the ground. He quoted the opinion of other American and of French engineers from reports submitted to the meeting of the International Railway Association held at Rome last month. The French decision was that 1,500 volts is the maximum permissible near the ground, and for higher volts overhead construction must be used.

Mr. George Gibbs' report at the same meeting was quoted as follows—

> "There are important objections to a third rail being used for general electrification."
>
> "Serious consequences increase rapidly as the voltage in third rail is raised."
>
> "Weighty objections to the use of 1,200 or 1,500 volts in third rail."
>
> "Impracticable to instal it within American railroad clearances properly insulated and protected in a manner which will adequately safeguard the public and employees."
>
> "The decision which has been arrived at in England (Ministry of Transport's Electrification of Railways Advisory Committee's Final Report 1921) to allow the installation of a 1,500 volt third rail is, presumably, for special cases only, and for operating conditions and clearances which do not exist in America."
>
> "Overhead conductor promises to become standard for heavy electric traction . . . provides continuous contact at the train over complicated track layouts."

The most economical overhead distribution to trains was shown, with acknowledgment to the British Aluminium Company for loan of lantern slides illustrating the Lake Erie and Northern Railway's long span catenary consisting of a steel core, for strength, and aluminium surround, for conductivity, thereby doing away with all expense for separate feeders.

The lecturer, having both American and British experience, stated that the small wheels on much American rolling stock necessitates a greater space between third rail and running gauge line than in England, but he knows of nothing to warrant 1,500 volts in a third rail near the ground either in England or America.

Danger of High Voltages at the Surface.

The more important consideration, in his opinion, was that to supply a third rail with 1,500 volts very seriously adds to the risk to lives of employees on permanent way work, and to any member of the public who accidentally gets on the line. Under such probabilities of death the higher voltages near the ground he declared are not justifiable, even if they were cheaper to instal or cheaper to operate, but he contended that they are not cheaper, and gave estimates in support of his belief, which are below set out.

In some London tubes for legal requirements a fourth rail is installed, but the electrical potential is comparatively near to that of the running rails, so that to touch *this* fourth rail involves small risk of electric shock, unless the person has an unusually weak heart. (The lecturer told of one instance when one of his employees got a shock from a sheet of iron lying on wet ground, which, on test, showed 20 volts to "earth.")

The lecturer anticipates that the Ministry will make rules that will prevent the use of a fourth rail at even —600 volts from the running rail in addition to +600 on third rail, because with third

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and fourth rails there is not room to carry on the work necessary on permanent way, and it could only be a menace to the lives of everyone who comes near.

Advisory Committee's Report.

Dealing with the Advisory Committee's report, he insisted that it is necessary to apply the tests of practicability and safety and economy to this committee's advice. He finds no evidence in their report that consideration was given to the necessity for protecting employees and public from unnecessary risks to life from 1,500 volt conductors near the ground; no evidence that those officials of the Ministry of Transport whose duties include caring for the safety of the public were called before this Advisory Committee in reference to third or fourth rails. They dealt with overhead conductors only as stated, page 5, line 55, of the report.

Nor does he find any evidence that the committee considered in detail what is involved in their statement that 1,500 volts, *or a multiple of* 1,500, should be permitted on a third rail (page 4, lines 26 and 29 of report).

A three-wire system used to exist in the two parallel tunnels of the City and South London Tubes, where each tunnel had a separate 500 volt system with a total of 1,000 volts. The two were separated by such a distance that no one could get a 1,000 volt electric shock.

It seems extraordinary that the committee agreed to a multiple of 1,500 volts on a third rail without even wisely limiting the multiple.

It is fortunate for the public that the Ministry, by publishing that report, did not sanction anything so liable to cause unnecessary deaths as is inseparable from a high voltage in a rail near the ground within easy reach of anyone. Even trespassers do not deserve sudden death as punishment for trespassing; and no one really acquainted with permanent way work will suggest that it is practicable to complete within the few hours when trains are not running all the work essential on permanent way.

On one third rail 600 volts is fairly safe, but the multiple of 1,500 volts filled the lecturer with alarm, and he asked, "How could that committee contemplate such a risk to life?" Did they consider it? Then why does not the report say they did?

The considered opinion of the Ministry's official, who is responsible for the safety of the public, is needed on this multiple of 1,500 volts, where anyone can easily get a fatal shock from third or fourth rail.

Comparative Costs of Use of Different Voltages.

Carefully prepared estimates for 600 volts and for a multiple of 1,500 volts, based on details of British suburban services, show that there is no advantage in cost, and that whatever is spent on rendering protection to life by guarding third, and/or fourth, rail from contact adds further to the disadvantage in capital cost and in maintenance cost of the higher voltage (as compared with 600 volts).

Having in Mr. George Gibbs' report to the International Railway Association (April 1922), *inter alia*, engineering details of the Long Island Railway, "an example of electrification of a compact network of lines none of which extend more than 30 miles; therefore current distribution can be made economically by a low voltage system."

Closely resembling the basis used for the above British estimates, a practical interest was added by giving the essential basic values comparatively, as follows

	Existing Long Island Railway.	Basis of Estimates below.
Route miles	90	100
Single track miles	227	200 plus sidings
Lines extend from terminus ...	30	18 miles
Motor cars	494	33% less
Trail cars	140	15% more
Number of sub-stations	14	16
Sub-station plant	56,000 K.W.	55,000 K.W.
Miles between sub-stations ...	4·5	Same
Maximum trains per day ...	730	5% less
Maximum peak load	34,400 KW.	15% more
Rush hour load	—	27,500 KW.
Passengers, 1920	59,134,000	—
Train miles, 1920	3,769,000	50% more
Car-miles, 1920	20,400,000	40% more
Kelvins supplied, 1920	104,030,000	18% less
Ton miles, 1920	906,100,000	—
Maximum train	672 tons	45% lighter
Average speed	32 miles per hour	20% slower

1922 Comparative Estimates of Capital Costs of Electrifications of Suburban Railway (details above).
Prices are given in £ per single track mile.

Voltage Collected.	600 volts.	Double 1,500 volts.
Power-house	£6,000	£6,000
Cables and sub-stations	5,000	2,500
Track work	3,000	7,500
Rolling stock and electrical equipment	15,000	16,000
	£29,000	£32,000

BUILDING EXHIBITION AT OLYMPIA.

Among the stands at the Building Exhibition, Olympia, which concluded on Thursday, April 27, were several containing material and products of interest to tramway managements and municipal authorities generally. The British Reinforced Concrete Engineering Company, of 1 Dickinson Street, Manchester, had specimens of their well-known fabric on view in various forms—B.R.C. columns, beams, and the familiar "slabs." Among the many excellent photographs of road reinforcement work in different parts of the country which were exhibited was one showing two adjoining sections of a tramway track laid in sets. While that section which had been laid on B.R.C. fabric appeared in excellent condition, the stretch not so supported had sunken badly. John Yates and Company, of Aston Manor, Birmingham, exhibited a large selection of tools, plant and stores for contractors, public authorities, tramway undertakings, etc. Among the items noted were rail carriages, jim crows, rail-carrying tongs, jacks, tie-bar spanners, post-hole borers, and a wide variety of shovels and picks. Millars' Timber and Trading Company, of Pinners' Hall, Great Winchester Street, E.C.2, being unable to secure a sufficiently large stand to do justice to their extensive range of labour-saving machinery for road and building construction, arranged a fine selection of photographs of typical machines. For visitors who desired to see a practical demonstration, the firm organised a service of cars to their works at Kirtling Street, Battersea, S.W. Ferodo Limited, of Chapel-en-le-Frith, had on view samples of their fibre stair treads, Feroleum floorings and nosings. What appeared to be a very useful attachment to tramcar running boards and stairs was a serrated metal edge, fitted in conjunction with Ferodo treads.

The Laffly (England) Company, of Lonsdale Road, West Kilburn, showed examples of the petrol engines taken from their road-sweeping, gully emptying, watering and other municipal machines. Building Products, Limited, of King's Road, S.W.3, were represented by a stand at which were demonstrated the insulating qualities of Cabot's quilt, which is being largely used in structures where it is desired to deaden noise or to keep an even temperature.

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TRANSPORT CONGRESS.

PROGRAMME OF IMPORTANT LONDON GATHERING.

Considerable interest is being taken in the Congress which is to be held in London from Wednesday, May 17, to Saturday, May 20, under the auspices of the Institute of Transport. Delegates are expected from the British Dominions, the United States of America, and the Continent. Papers will be read and discussed at meetings to be held on the mornings of the first three days at the Institution of Civil Engineers, Great George Street, Westminster, and a lecture to graduates and students will be delivered at the rooms of the Royal Society of Arts, John Street, Adelphi, W.C.2, at 5 p.m. on May 19. The afternoons of the three days and the Saturday following will be devoted to visits of inspection.

The Lord Mayor of London (Alderman Sir John J. Baddeley) has invited the delegates to a conversazione at the Mansion House on the evening of May 17, and the third dinner of the Institute will be held on the following evening. Subject to limitations of accommodation, each member attending the congress may invite one visitor to meetings and visits. Ladies accompanying the delegates and visitors may attend the Mansion House conversazione and the Institute dinner. The headquarters of the congress will be at the Hotel Metropole, Northumberland Avenue, London, W.C. Mr. H. E. Blain, C.B.E., honorary secretary of the Institute of Transport, has issued the programme of the Congress, which is as follows—

TUESDAY, MAY 16.

7 to 10 p.m.—Reception by the President (Sir Henry P. Maybury, K.C.M.G., C.B.), at the Hotel Metropole.

WEDNESDAY, MAY 17.

9.30 a.m.—The President will open the Congress.

10 a.m.—"Recent Improvements in transport facilities in the Port of London." By Sir Cyril Kirkpatrick.

11.15 a.m.—"Wireless as an aid to transport." By Captain M. P. H. Riall Sankey, C.B., C.B.E.

10 a.m.—"The design, construction and maintenance of highways in relation to the development of mechanically propelled vehicular traffic." By Col. C. H. Bressey O.B.E.

8 to 11 p.m.—The Lord Mayor of London will entertain the Congress at a conversazione at the Mansion House.

THURSDAY, MAY 18.

10 a.m.—"Inland water transport—a practical policy." By Mr. Neville Chamberlain, M.P.

10 a.m.—"The future design of road vehicles for passenger and goods services." By Sir J. E. Thornycroft, K.B.E.

7 p.m.—Dinner of the Institute.

FRIDAY, MAY 19.

10 a.m.—"The finance of the modern highway—a problem and a solution." By Mr. Dixon H. Davies.

10 a.m.—"Foreign railway practice." By Prof. J. Carlier.

11.15 a.m.—"'Safety' in railway operation." By Col. J. W. Pringle, C.B.

5 p.m.—"The operation of heavy suburban passenger services on a steam railway, with particular reference to the density of service, terminal and other facilities." By Mr. F. V. Russell, C.B.E. (This paper will be read at the rooms of the Society of Arts.)

Several prominent members of the Government will attend the annual dinner on May 18, and a distinguished company is expected. The speeches will be limited and an excellent musical programme has been arranged. The papers to be read at the Institution of Civil Engineers, as mentioned above, on the mornings of the 17th, 18th and 19th, cover a wide range of subjects and are of particular interest. While all are likely to be of considerable merit, three may be singled out as calculated to provoke valuable discussion, those by Mr. Neville Chamberlain, M.P., Sir John E. Thornycroft and Mr. Dixon H. Davies. A full attendance is anticipated at the lecture to be delivered at the Royal Society of Arts, on the 19th, by Mr. F. V. Russell, C.B.E. Space will not permit of a full description of the numerous visits arranged for the afternoons of the 17th, 18th and 19th, and on the Saturday following. Excellent provision has been made for the comfort of those participating. The following are a few instances of what have been arranged:

On Wednesday, the 17th, the party visiting the docks will travel by special train provided by the Great Eastern Railway, leaving Liverpool Street at 2.30 p.m. and, on arrival at Custom House, will inspect the tobacco warehouse. They will then embark on a tug, which has been placed at the disposal of the Institute by Mr. W. H. J. Alexander, and proceed through the new passage to the King George V. Dock, and steam round the Dock inspecting *en route* the entrance lock, jetties, sheds, equipment and dry dock, afterwards visiting the new double-storey shed and the models of improvement and development works. Tea will be served, and the party will re-embark on the tug and proceed by river to Custom House Quay, near the Tower of London. Visitors to the Neasden Power Station will travel by special train to Rickmansworth, where they will be entertained at luncheon by the Metropolitan Railway and will subsequently return to Neasden and inspect the Power Station. Those inspecting the new Great West Arterial Road will travel to Hounslow Barracks Station by District Railway.

On Thursday, the 18th, at the conclusion of the morning session, specially reserved omnibuses will convey delegates to the Chiswick Works of the L.G.O.C., where light luncheon will be provided by the Company. Afterwards, an inspection of the works will be made, to be followed by a visit to the power station of the Underground Railways at Lots Road, Chelsea. The same afternoon, another party will inspect the new offices of the London and South Western Railway, at Waterloo, and subsequently travel by special train to Feltham and be conducted over the Marshalling Yard. An alternative visit will be to the company's power station at Wimbledon.

On Friday there will be a choice of three exceptionally attractive visits. The London, Brighton and South Coast Railway will run a special train from Victoria to and from the London Terminal Aerodrome at Croydon. Among many sights to be seen will be the hangars, workshops and buildings of the several companies operating the Cross Channel Air Service. The London County Council will run special cars starting from the Victoria Embankment for those visiting the Greenwich generating station and car repair depot at Charlton, and will provide tea at Charlton. For those inspecting the Great Western Railway Company's signal works at Reading, special travelling facilities will be provided by the Company.

On Saturday, the 20th, an inspection will be made at Liverpool Street Station of the early-morning suburban traffic operation. Later on, three alternative visits have been arranged. The party visiting the works of Messrs. Dennis Brothers, at Guildford, will probably travel from and to London by motor conveyances. Those who elect to visit Euston Station and Stonebridge Park power station will also be entertained at luncheon by the London and North Western Railway, while those who proceed to Marylebone Station will witness a demonstration by the Great Central Railway of pulverised coal and colloidal fuel. Additional visits have been arranged to the Central and London Trunk Telephone Exchanges, the London County Council Housing Estate at Dagenham, and the Fuel Research Station at Greenwich. The Transport Exhibit at the South Kensington Museum will repay a visit, and is open on weekdays from 10 a.m. to 6 p.m. and on Sundays from 2.30 to 6 p.m. Those desirous of participating in the Congress are urged immediately to communicate with the Hon. Secretary of the Institute, at 15 Savoy Street, London, W.C.2.

ROAD MAINTENANCE.

NEW SUGGESTIONS BY WORCESTER COUNTY SURVEYOR.

At a meeting of the Institution of Municipal and County Engineers, held in London on April 20, Mr. C. F. Gettings, the Worcestershire County Council surveyor, read a paper entitled "Maintenance of Highways as Affected by Finance." With the exception of large cities of considerable area, Mr. Gettings suggested that economies could be effected if the country was divided into suitable areas, similar to counties, but avoiding the present interlacing, and the whole of the roads in the respective areas placed under one control. The roads should be classified, and grants made to the areas by the Treasury which should be proportionate to the classification and mileage of the roads. It might be suggested that a number of officials who held office at the present time would be affected; but it would be possible to absorb the majority, and in course of time the organisation could be so arranged that the administration would be more effective and economical than at present. If the method indicated were adopted it would be possible to co-ordinate the work in each area, and make better arrangements for the purchasing and distribution of materials. The heavy mechanical vehicle, whether omnibus or heavy lorry, was not contributing proportionately to the damage done to the roads, and it was only fair that increased funds should be derived from this source. The public, who used the motor omnibus, and who obtained goods that were conveyed by road transport, benefited indirectly, and it was only reasonable they should be called upon to contribute towards the cost of the roads. If the control of the highways was placed in the hands of one authority, comprised of representatives similar to a County Council, the administration might well be left in their hands, as more economical results would be obtained. It was desirable to have an impartial authority to arrange the distribution of grants.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, MAY 18, 1922.

Railway Electrification.

During April an official list was published of schemes which receive a Government guarantee both as to principal and interest of loans for carrying out new works. The guarantee arrangement, it may be recalled, is provided for in the Trade Facilities Act 1921, and the immediate object is to facilitate the raising of capital at a low rate of interest for new works of public utility, so that employment may be found for many men out of work. It is significant of the importance attached to electric railways that out of a total of £14,958,145 guaranteed for fourteen different industrial projects, no less than £11,500,000 should be for railway electrification and for the improvement and extension of existing electric railways. The guarantee in respect of £5,000,000 to the London Underground Railways had previously been announced. The main works to be carried out with this new capital are the enlargement of the tunnels of the City and South London Railway, the extension of the London Electric Railway from Golder's Green to Edgware, improvements of stations, and provision of new rolling stock. The works have long been authorised, and the plans matured, so that an early start is possible. The other guarantee is in respect of no less than £6,500,000 for the electrification of the suburban lines of the South Eastern and Chatham Railway. This will be one of the biggest single jobs of the sort hitherto carried out in this country, embracing as it does a network of lines over a wide area to the south-east of London. The general scheme has been worked out, so that it is probable no great delay will occur in making a start. The possibilities of traffic development, when the competition of the electric tramcar and the motor omnibus need no longer be feared, are very great, especially when it is remembered that the South Eastern and Chatham Railway has several large terminal stations in the heart of London. The two companies concerned may be expected not only to win back lost suburban traffic, but to create a great deal more in connection with places further out which will be brought in point of time much nearer both to the City and the West End. It is in connection with this electrification scheme that a construction company is to be formed to carry out the electric equipment and to work the electrified lines for a period of years under a leasing and sinking fund arrangement by which it is calculated the new capital will gradually be wiped out. Apart from the alleviating of unemployment, both of these schemes will be of great and permanent benefit to the public.

Electricity Supply.

Since last year a great deal of negotiation has been going on privately between the Ministry of Transport and various interests concerned in the Electricity Supply Bill, with the result that a great deal of the opposition to that measure has been withdrawn. This may be judged from the fact that the Bill has passed through the House of Lords (where it has been regarded with so much suspicion) with only a few amendments not of a vital kind. The main object of the measure remains, namely, to authorise the local joint electricity authorities which are being constituted under the Electricity Supply Act of 1919 to raise capital by borrowing. They should have had that power to begin with, but it is better late than never. Once the power has been obtained they will be

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able to proceed properly with their work of consolidating, co-ordinating and developing the supply of electricity for all purposes throughout the country. Without the power sought they could only work the finance of schemes indirectly by the constituent members represented on each authority raising capital. If the Government show themselves at all in earnest in the matter, they should have little difficulty in getting the Bill through the House of Commons this year. When passed, and taken along with the original Act, it should prove of great advantage to the country. It does not contain the general compulsory powers which had to be dropped from the original Bill of 1919, but though the powers are now voluntary or optional it is probable that the various districts will see that there are open such possibilities of benefit in the arrangements that generally speaking they will gladly adopt them.

The Transport Congress.

Those who come to London to attend the four days' Transport Congress which is being held from the 17th to the 20th of this month, will not only engage in proceedings that will be full of interest, but they will be invited to participate in a series of visits of inspection which are sure to prove exceptionally attractive. The programme arranged by the Institute of Transport includes tours of such varied centres of transport activity as the new Waterloo Station, the international air port at Croydon, and the London Docks. It is unlikely, however, that anything will eclipse in interest the visit of the delegates to the power-station of the Underground Railways at Lots Road, Chelsea. The observant visitor to London is usually impressed most of all by the remarkably smooth and efficient way in which the enormous volume of passenger traffic is handled, especially during the busy periods of the day. The man in the street—to use the term in its strictly literal sense—is, however, apt to forget when viewing the traffic the fact that there is always another great army of passengers being carried below his feet by the Underground Railways. Indeed, were it not for this vast network of lines, four alone of which last year carried 339 million passengers, it is difficult to conceive of the chaotic state in which London would find itself to-day. It is a significant fact that this underground system, so essential a part of the Metropolis, has been built up without Governmental assistance or even encouragement. The enormous sums necessary have been provided from private capital—not all of which has even yet become remunerative—and the system has been developed by careful study of London's needs, by an untiring spirit of enterprise, combined with the services of eminently skilful engineers. And so at the Lots Road station the visitors will see the splendid equipment which generates the power not only for practically the whole of the Underground Railways, but for several tramways associated with the Underground Group. To say that the great plant on the bank of the Thames represents the high-water mark of engineering attainment is to use no empty phrase. As was mentioned in the illustrated description of the power-house which appeared in our issue of October 20, 1921, the aggregate capacity of the ten turbo-generators is now over 78,000 KW. The two latest machines have an economic rating of 15,000 KW. and a full-rated continuous capacity of 18,000 KW., while the eight older generators have each an output of 6,000 KW. The visitors will also be interested in such new features as the circulating water service, with its large and ingenious screening pit for the removal of undesirable floating matter from the Thames water; the 14,000-ton coal storage tank; the elaborate coal-handling equipment, and the new machinery in the boiler feed-pump house. A feature of the boiler-house at Lots Road is that the boilers, which now number almost 70, are arranged on two floors. To visitors from the British Dominions and the United States especially the visit to Lots Road should be particularly attractive, as it can truthfully be said that the development of the power-station has been watched by engineers in every part of the world.

Proposed Underground Railway for Tokio.—The prospects of the scheme for constructing an underground railway in Tokio are receiving a good deal of attention at present, says the *Times of India*, owing to the difficulty of solving the traffic problem, which is acute. A motor omnibus service would be useless, the paper says, "owing to the state of the roads and the electric wires which run overhead lengthwise and crosswise." An underground railway is therefore generally desired, and as experimental borings have disproved a supposition that the subsoil is too soft, the feeling now is that the scheme will be successfully accomplished.

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SAFETY IN RAILWAY ELECTRIFICATION.

In the running of our railways the safety of the general public and of railway servants in particular should always receive unqualified support before considerations of mere economy. In justice, however, not only to ourselves but also to the representative list of engineers who composed the Electrification of Railways Advisory Committee to the Ministry of Transport, we dissent from some conclusions stated in the lecture on "Safety," with which we deal, at the length it deserves, on another page. That a report is stated to say nothing about the safety of permanent way workers cannot reasonably warrant the suggestion that the Advisory Committee, who prepared it, overlooked any aspect of the safety problem.

To assume that the Advisory Committee were willing to put even twice 1,500 volts "on third, and/or fourth, rails" is, in our opinion, unduly reading between the lines of their report. We consider where "multiples of 1,500 volts" were named in their report that no member of the committee had any intention that it should be located "near the ground." The Advisory Report states the committee received a report from Mr. George Gibbs, consulting engineer to the Pennsylvania Railroad and to the Delaware, Lackawanna and Western Railroad, etc., who was chief engineer on the electrification of the New York City suburban railway, from which company the Great Eastern Railway took its general manager. It is no secret in London that he also has reported on the electrification of the Great Eastern Railway Company's suburban lines. His recent public statement in Italy shows his opinion (which the lecturer quoted) that there are weighty objections to the use of even 1,200 volts in a third rail.

It is opportune to summarise the opinion of practical experts on the general problem of railway electrification.

The Advisory Committee's Final Report 1921, recognised the large financial expenditure already incurred on the Brighton Railway's single-phase equipment, and decided to leave it alone. More recently that company withdrew a Bill it had deposited for raising more capital for electrification.

American, as well as French, experts have decided that no higher voltage than 1,500 can be allowed "near the ground," also that the cost of 2,400 volt—or of 3,000 volt—electrification is in excess of both 600 and 1,200 volt electrification. These higher voltages are therefore ruled out both on the basis of safety to railway servants and on the basis of economy.

The French Government's committee who examined electrifications at home and in all other countries published a voluminous report which includes numerous and comparative estimates. That report is available partly in *Revue Generale des Chemins de Fer*, Paris, Vol. 40, pp. 313-352, and in "Institution of Civil Engineers' Abstract," 226, p. 148, October 1921.

Their estimates prove that "even the larger number of sub-stations for the lower voltage involves less total cost than the higher voltage." "The cost of 1,500 volt locomotives is lower than that of 2,400 volt or 3,000 volt locomotives." "No multiple unit equipments at 3,000 volts are in existence yet."

There are only three 3,000 volt electric railways in the world. Both use "overhead" contact. Locomotives draw passenger trains on them. They are the Chicago, Milwaukee and St. Paul Railroad (U.S.A.), Paulista Railroad (Brazil), and the Valparaiso, Santiago (Chile).

Up to the present electrification has been limited to three especial reasons—

(1) Tunnel ventilation not providing sufficient air for burning coal and keeping passengers supplied with sufficient oxygen.

(2) Heavy suburban traffic. Within a radius of 30 miles there is no need for more than 600 volts, and the Advisory Committee's report shows they expected London to continue and to extend the already considerable mileage running at 600 volts.

(3) Heavy grades. Regeneration of power from trains descending is also of value, and for regeneration at moderate speeds direct current is essential.

Three-phase regeneration is extremely simple, but only at speeds above synchronism, which means at speeds higher than the same train could run on straight, level track. Reasonable considerations of safety prevent risking such excess of speed to attain the advantage of a money saving in brake blocks, wheel and track wear.

The French report tells us where voltages above 1,500 might be preferable—note that they say "might be"—i.e., "in special cases where the traffic is *light*." We are satisfied that in such cases the steam locomotive is likely to continue to be the most economical method. "Special cases" exist in two feeder lines in Italy, now being electrified, to save long journeys over electrified lines to take steam locomotives to and from distant repair shops.

The 3,500 volt *overhead* equipment from Bury to Holcombe Brook on the Lancashire and Yorkshire Railway was experimental, and is no longer in existence.

The Electricity Commissioners, under their Act, deal with generation of electricity. Other officials in the Ministry of Transport are charged with providing for the safety of all of us. We feel confident that they will not permit voltages "within reach of anyone" which are more dangerous, or less safely protected, than the 1,200 volt third rail now in service on the Manchester-Bury line.

BUSINESS NOTICES.

THE JACK ENGINEERING COMPANY, of Ferdinand Place, Chalk Farm, London, N.W.1, now hold a full range of spare parts of all standard jacks. Parts required for replacement can, we are informed, be despatched immediately on receipt of application quoting type and number.

NOBEL INDUSTRIES, LIMITED, of Nobel House, S.W.1, have notified the Board of Trade that they propose to support the British section, which is being organised by the Department of Overseas Trade, in the Rio de Janeiro Exhibition, which opens on September 7 next. They will exhibit a range of products similar to those now installed for the inspection of visitors at the British and Latin American Chamber of Commerce, 39 Bedford Square, London, W.C.1.

"B.R.C. ROADS."—Under this title the British Reinforced Concrete Engineering Company, of Dickinson Street, Manchester, have issued an illustrated record of examples of their work, which sets an unusually high standard as a commercial publication. It contains 160 pages of excellent photographs taken in all parts of the British Isles and abroad, showing roads of every kind either under construction with B.R.C. fabric or in their completed state. There is little comment, for little is needed, as the captions under the illustrations show that most cities and towns of consequence realise the need for an efficient and durable method of road construction. In the preface, however, it is pointed out that B.R.C. tramway foundations, like the ordinary roadway foundations, afford a permanently level bed on which to build a lasting superstructure. The effect of the reinforcement is to spread the load over the whole width of foundation. Apart from its publicity uses, the book, which is charmingly finished in leather, may be regarded as a welcome contribution to the literature of road construction and maintenance.

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INTERNATIONAL UNION OF TRAMWAYS.

RECONSTITUTION AT BRUSSELS.

At the meeting of the International Union of Tramways (Union Internationale de Tramways, de Chemins de fer d'Intéret Local et de Transports Publics Automobiles), which was held at Brussels on February 18, M. C. Burlet, president, occupied the chair, and 128 members or their representatives were present. The president welcomed the members, and thanked particularly those who had come from a distance to assist at the reconstitution of the Union. At the outset he referred to the death of two members of the Council, M. A. Bertini, director general of the "Societa Generale Italiana Edison di Elettricita," Milan, and M. J. H. Neiszen, director of the Amsterdam Municipal Tramways. They were, he said, not only well known in the tramway world and able engineers, who had taken great part in the work of the Union, but men of sound counsel and always cordial and courteous in their relations with their colleagues. Upon the invitation of the president, the members rose as a sign of respect for the two late members.

The President then recalled the circumstances which had arrested the work of the Union during many long months. Many colleagues anxiously desired to resume the work. It was the very lively desire of the Council, who had suffered more than anyone from the long period of enforced inaction. To-day, thanks to the promulgation of the Belgian law relative to the liquidation of sequestered property, every obstacle to the dissolution of the old Union and its reconstitution had finally disappeared. The President addressed an urgent appeal to all his colleagues to lend their best assistance to the new organisation which the committee proposed to form, in order to continue the useful work of the Union. The President then gave an explanation of the procedure to be followed in the dissolution of the old Union, and the assembly unanimously adopted the following resolution—

> "The assembly, taking note of the dissolution of the International Union according to the law of November 17, 1921, approves the division of the assets which has been made. The part falling to members from the central countries has been transferred to the special account required by law and by the treaty of Versailles. The assembly decides that the remainder of the property shall be invested in the reconstituted Union under reservation of eventual rights of old members not adhering to the new organisation."

The President then proposed the constitution of the new international association and examination of the articles, taking as a basis for this work the articles of the old international union, which had proved so satisfactory during many years. These articles were unanimously adopted after careful discussion.

M. K. Norregaard proposed that they should adopt French and English as official languages of the association. The President explained that at present there were only a few English members, and owing to reasons of economy he thought it wise at the moment to limit the official language to French. This was agreed to.

The President announced that the former committee of the Union had addressed to the members of the old Union not represented on the committee a request that they should appoint a delegate to represent them on the Council of the new association. The following list, drawn up in this way, was submitted for the approval of the assembly—

FORMER MEMBERS.

BELGIUM.—MM. C. de Burlet, Directeur Général honoraire de la Société Nationale des Chemins de fer Vicinaux; H. Géron, Administrateur de la Compagnie belge de Chemins de fer et d'Entreprises; J. Kessels, Administrateur de la Société Générale de Chemins de fer Economiques; Ch. Thonet, Administrateur, vice-président de la Société Anonyme d'Entreprise Général de Travaux.

FRANCE.—MM. A. Mariage, Président du conseil d'administration, Administrateur-délégué de la Société de Transports en Commun de la Région Parisienne; G. Pavie, Administrateur de la Compagnie Générale Francaise de Tramways.

SWITZERLAND.—M. Ch. Rochat, Directeur Général de la Compagnie Genevoise des Tramways Electriques.

NEW MEMBERS.

DENMARK.—M. Kai Norregaard, Directeur des Tramways de Copenhague.

SPAIN.—M. le marquis de Foronda, Administrateur, Directeur Général des Tramways de Barcelone.

FRANCE.—MM. F. Level, Directeur de la Compagnie Générale de Voies ferrées d'intérêt local; L. Boulle, Administrateur-délégué de la Compagnie Général Francaise de Tramways.

HOLLAND.—M. J. W. van de Vegt, Directeur de la Société des Tramways Electriques de Rotterdam.

NORWAY.—M. J. F. S. Barth, Ingénieur, Directeur de la Société des Tramways Electriques de Christiania.

On the motion of M. L. Sékutowicz, the members of Council were elected with acclamation. Several Belgian members then expressed the wish that one or more representatives of the "Federations des Tramways Electriques de Belgique" and of the "Union des Cessionnaires d'Exploitation des Chemins de fer Vicinaux," who are directly connected with traffic direction, should be admitted to the Council at a convenient opportunity. The President was agreeable to the suggestion, and only regretted that it was not made at a suitable moment. He promised that it should receive favourable consideration. On the motion of the president, the assembly confirmed the election of M. le baron L. Garssen as "Honorary President" in recognition of his great services over a long period.

The assembly unanimously decided that the next congress should be held in Brussels in the first fortnight of October 1922. M. Koettlitz moved that the following motion should be included in the agenda—"To establish the extent of damage done in various allied countries that were devastated or occupied during the war." He was requested to submit his proposal in writing, and the president explained that for lack of time to issue the usual schedules of questions, it would be necessary to limit discussion at the congress to subjects covered by papers which members would submit. The Council would be responsible for the necessary arrangements.

The General Secretary gave a summary of the financial position of the Union, which was regarded as satisfactory.

The agenda being exhausted, the President again thanked the many members present for the declaration of their desire for the continuance of the valuable work of the Union. He asked all to support the new association, and to establish interest in it wherever possible, that it might be strong in the accomplishment of its objects to effect improvement in the means of transport, and so conduce to public prosperity.

M. Level (president du Comité Central de l'Union des Voies Ferrées d'intérêt local et de Transports Publics Automobiles de France) thanked the president in the name of the assembly; he expressed the delight of all at meeting after so long and terrible a separation in glorious Belgium, the symbol and the martyr of the great war.

THE BEAMA CABLE CODE.

The British Electrical and Allied Manufacturers' Association, whose headquarters are at 36 and 38 Kingsway, W.C.2, have issued what is bound to prove a most useful and economical Technical Cable Code, with a view to facilitating and cheapening the transmission by telegraph of business correspondence and data. Regarded in the first place merely as the product of the printer and binder, the book, which is published at five guineas, is a very substantial and imposing piece of work. From the binding to the outer edge of the cover it measures 14½ inches; from top to bottom, 11½ inches; and the two stout red covers may be expected adequately to fulfil their purpose in withstanding the wear occasioned by frequent reference. The 200 pages are of thick parchment-like ledger paper; the printing is bold and clear, and the numerous tables conveniently arranged and well displayed. A noteworthy feature is the adoption of loose-leaf binding, which will permit subscribers to add fresh sections as they are published.

The publication of the code has arisen from the long standing need of the principal exporting houses connected with the Association, who desired a code which would be at once comprehensive, accurate, and economical. Most of the cable codes at present in existence are designed to meet the general requirements of business, and none of them is especially intended to cover technical details such as are used in connection with quotations and tenders for electrical and other machinery. There was a distinct need for a technical code which would meet such cases. Many of the larger manufacturers have private codes for their own branch of industry, but these codes necessarily contain references to their own standard types, and are designed to meet their special requirements, so that even if published they would be of limited usefulness.

The new Beama Code is based on work by the author, Mr. John F. Shipley, M.I.E.E., but has been amplified by specialists connected with firms in the association who are in daily contact with both the technical and commercial sides of their business. The phrases used in the code are therefore such as regularly occur in inquiries and contracts; they have been made as comprehensive and complete as possible. The work has also been submitted to the coding experts of various companies in the B.E.A.M.A., so that difficulties that arise with existing codes have been avoided. The terms given in the code cover all branches of electrical and allied engineering and are in accordance with the latest practice, references being given to all standardisation rules, both British and Foreign. The publishers estimate that as compared with any other code now published, it will be possible with the Beama Code to reduce the number of coded words by approximately 75 per cent. The initial cost of a few copies of the code, they expect, will be covered in the first half dozen messages transmitted, particularly if these be long-distance communications.

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MANCHESTER TRAMWAYS MANAGERSHIP.

MAJOR HENRY MATTINSON APPOINTED.

Major Henry Mattinson (late R.E.), chief civil engineer of Manchester Corporation Tramways, has been appointed general manager in succession to Mr. J. M. McElroy, whose resignation, owing to ill-health, was reported in our issue of February 25, 1922. Mr. Wood, assistant manager, is also about to retire. There were 39 applicants for the post, and the Tramways Committee interviewed two of these, besides Mr. Mattinson—Mr. E. S. Rayner and Mr. J. S. D. Moffet, the general managers of Hull and Belfast tramways respectively.

Major Henry Mattinson.

The appointment carries a salary of £1,400 a year, and Mr. Mattinson will commence his duties on July 1.

The new manager has been associated with the Manchester Tramways for 21 years, and has been chiefly responsible for the construction of almost the whole of the 220 miles of single track which the system possesses. When Mr. McElroy visited the Continent and America to study traffic conditions, Mr. Mattinson accompanied him, and afterwards collaborated with him in preparing reports. Mr. Mattinson served his articles in Leeds, and before going to Manchester held appointments under the Corporations of Hull and Wolverhampton. He is an Associate Member of the Institution of Civil Engineers, a member of the Institute of Municipal and County Engineers, and a member of the Institute of Transport. During the war Mr. Mattinson obtained further professional experience in the army abroad, and gained the rank of major. He joined the East Lancashire Royal Engineers in 1915, and acted as adjutant at the Carnarvon R.E. training centre. Later, he served with the Egyptian Expeditionary Force between Gaza and Aleppo, and as construction engineer, light railways, directed the construction of over a hundred miles of track in this region. Following the defeat of the Turks in 1918, Major Mattinson was placed in charge of the restoration of the 600 miles of captured railway from Haifa to Damascus, Beirut, and Aleppo.

BELFAST TRAMWAYS' CHAIRMAN HONOURED.

Councillor W. G. Turner, chairman of Belfast City Tramways Committee, and an ex-High Sheriff of the city, has been honoured with a civic presentation in recognition of his distinguished municipal services. Councillor Turner has for many years served on the City Council, and in 1920 he was unanimously elected High Sheriff. At the conclusion of a term of office marked by a keen sense of public duty and generosity, it was felt that his services should be recognised. This popular decision had a sequel on April 27, when two portraits of himself were presented to Councillor Turner—one for inclusion in the permanent gallery at the City Hall, and the other for his own home. In addition, the chairman of the Tramways Committee received an illuminated address, in album form, while Mrs. Turner was the recipient of a diamond and sapphire cluster ring. The presentation ceremony was held at the City Hall, which had been charmingly decorated for the occasion. Alderman S. T. Mercier presided, and among those present were the Lord Mayor and Lady Mayoress (Sir William and Lady Coates), the High Sheriff, and many of Councillor Turner's colleagues and friends, including the general manager of the tramways (Mr. J. S. D. Moffet).

The address gave expression to the feelings of admiration and esteem which the donors so warmly entertained for Councillor Turner. "As High Sheriff for the County of the City of Belfast in 1920," it read, "your year of office was a busy and arduous one, but you fulfilled the duties and responsibilities of the position in a manner which elicited the highest praise from your colleagues in the City Council and the citizens generally. Reference may be made to the dignity and ability with which you presided over many important meetings, to the courtesy and tact which you always displayed in the discharge of your manifold duties, to the generous aid which you extended to all movements for the general welfare of the city, and to the marked success which attended your chairmanship of the Tramways Committee. In social and philanthropic projects Mrs. Turner took an active part, and never spared herself in her efforts to assist the needy and suffering."

In his formal reply, Councillor Turner spoke of the gratitude with which he received the gifts, and added, "I prize more than I can express the approbation of my colleagues in the City Council and the citizens generally. You are also good enough to refer to my chairmanship of the Tramways Committee, a position which I have the great privilege of holding now for the fifth year; such a privilege is a distinction of which one may pardonably be proud, and it is gratifying to know that my efforts are regarded with so much approval. I warmly appreciate your kindly references to my wife, and on her behalf, as well as my own, I most heartily thank you for these tributes of your confidence and goodwill."

The Lord Mayor said Councillor Turner had been for many years a greatly appreciated colleague of his in the City Council. He was a man on whom they could thoroughly rely, and one to whom they could go when they were in difficulty. The High Sheriff (Councillor Harry M'Keag) said he desired to join with the Lord Mayor and the chairman in their expressions of congratulation to Councillor and Mrs. Turner. As one who had served in the Corporation with Councillor Turner, he realised the great services he had rendered to the city. Particularly as chairman of the Tramways Committee had his services been of value. The Right Hon. Sir James Johnston said it had been his pleasure and privilege to be associated with Councillor Turner during all his public career.

Others who testified to Councillor Turner's valued services included Alderman Sir Crawford M'Cullagh, M.P., Alderman J. A. Duff, M.P., Councillor D. Anderson, and the Rev. W. J. Baird.

Councillor W. G. Turner
(Chairman Belfast City Tramways Committee).

Councillor Turner supplemented his formal reply by saying that in the discharge of his duties as a member of the City Council he had received every assistance at the hands of all the officials. He had often said, and he sincerely believed, that, taking their chief officers as a whole, from the genial Town Clerk down, there was no city in the United Kingdom which had a better staff for ability, loyalty, and devotion to duty.

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WAGES AND CONDITIONS OF TRAMWAY EMPLOYEES.

LIVERPOOL CORPORATION TRAMWAYS.

NEW WORKING CONDITIONS—AGREEMENT WITH EMPLOYEES.

The following is the text of an agreement as to working conditions, etc., which was entered into between Liverpool Corporation Tramways Committee and their employees on March 22, 1922.

Clause 1.—The working week shall consist of six days of eight hours per day, inclusive of signing on and signing off.

Clause 2.—(*a*) Every employee except those required to sign the spare sheet shall be guaranteed a working week of 48 hours, inclusive of signing on and signing off, or payment equivalent thereto, subject to such employee presenting himself for work at the appointed time on each of the six days, provided that this condition shall only apply to men who were in the tramway service on or before December 31, 1921; (*b*) Employees who shall have joined, or who shall join the serivce after December 31, 1921, shall, for the purpose of the foregoing condition, be treated as spare men; (*c*) Employees who shall be required on any day to sign the spare sheet, shall be entitled, if they do not receive any duty on such day, to an allowance of four hours pay for such day, and employees who shall be required to sign the spare sheet for six days in any week shall be entitled to receive such a sum as, with such allowances as aforesaid, will amount to 32 hours' pay; (*d*) At no time shall there be more than 10 per cent. of the drivers and conductors on the spare sheet. Such 10 per cent. shall not include men who have been placed on the spare sheet for disciplinary reasons; (*e*) When any employee has been on the spare sheet—except those placed thereon for disciplinary reasons—for such time as entitles him to the maximum rate of pay, *viz.*, two years, he shall be treated as a full-time employee, and shall be guaranteed 48 hours pay per week.

Clause 3.—The Corporation shall be at liberty to utilise the services of any employee for whom work cannot be found on the cars upon such other work as may be considered desirable by the Corporation, subject to such other work not infringing on another man's job, and only being of a temporary character.

Clause 4.—Spread-over time shall be reduced to the lowest possible minimum, consistent with an efficient service, and in no case shall such spread-over exceed 12 hours per day.

Clause 5.—Overtime shall be calculated as time and a quarter for the first two hours, and time and a half for all hours afterwards. Each day shall stand alone as regards the payment of overtime.

Clause 6.—Ordinary Sunday work shall be paid for at the rate of time and a quarter.

Clause 7.—Any employee being called upon to work on his seventh or rest day shall be paid at the rate of time and a quarter on the rate prevailing on that day.

Clause 8.—The following days shall be recognised as National Bank Holidays—Easter Monday, Whit-Monday, August Bank Holiday, and Boxing Day, when time and a half shall be paid for all time worked.

Clause 9.—Christmas Day and Good Friday shall be paid for at the rate of double time, calculated on ordinary day rates. If any employee shall not be required to work on Christmas Day or Good Friday, he shall receive a day's pay, calculated on ordinary day rates, for each of such days on which he does not work.

Clause 10.—Eight days' holiday with pay shall be granted to all employees after 12 months' continuous service. In calculating such holiday, rest days shall not be included.

Clause 11.—No employee shall be entitled to payment in lieu of holiday.

Clause 12.—The adult rate of pay shall only apply to employees aged 21 years and over. Employees under the age of 21 years shall be paid on the scale at present in operation.

Clause 13.—The working week of night shed assistants shall consist of 48 hours, such hours to be inclusive of a meal-time of not less than 30 minutes each night. Shed assistants on day work shall be granted a working week of 47 hours.

Clause 14.—Shed assistants on regular night work shall be paid 1s. per night extra for night work, and shed assistants under the age of 21, 6d. per night extra for night work.

Clause 15.—(*a*) The present sliding scale revision of wages shall be continued in accordance with the changes in the cost of living Board of Trade index figure giving a variation of 1s. per week for every complete five points either way in the published figure for the month preceding that in which the revision is to take place, commencing from the figure of 135; (*b*) The next revision of wages shall take effect as and from the beginning of the first full pay period following May 1, 1922, and such revisions as shall have taken place previous to this agreement shall be taken into account in calculating the next revision; (*c*) After the next revision of wages shall have taken place, subsequent revisions shall take place every three months.

Clause 16.—In the event of a stoppage in the tramway service, whether complete or partial, from causes beyond the control of the Corporation, such as stoppages due to disputes, serious breakdown of machinery, etc., the guaranteed week shall be suspended, and only the actual time worked shall be paid for.

Clause 17.—This agreement shall come into force on April 4, 1922, and shall continue in force until revised or determined, but no revision or determination thereof shall be made unless and until three months' notice of such revision or determination shall have been given by the Corporation or the Employees as the case may be, and no such revision or determination shall take place before September 30, 1922.

Clause 18.—This Agreement shall not apply to employees whose wages and conditions of labour are governed by other Trades Unions Agreements and Awards.

RATIFICATION OF TRAMWAY AGREEMENT.

At a meeting of the National Joint Council for the tramway industry on April 11, reports of the constituent associations respecting the revised National Agreement were received. Mr. Fearnley reported that there was no dissentient among the municipal tramway authorities, and Mr. Tegetmeier reported that the conference of Tramway and Light Railway Companies had recommended to the companies concerned the adoption of the agreement. Mr. Cliff reported that the employees had by a majority decided to accept the agreement.

A question was raised as to the meaning of the words "this date" referred to in clause 2 (*a*) of the revised agreement, and it was resolved that the words "this date" be construed as the date of the signing of the agreement, viz., April 11, 1922. The committee recommended that the terms and conditions of service of the permanent way employees who had been working under the March, 1919, agreement, should be the subject of local negotiation and agreement between the undertakings concerned and the trade union representatives.

The resignation of Mr. W. J. Squires was accepted with regret, and the best thanks of the Council were accorded to him for his splendid services as chairman of the Council since it was formed. Mr. J. M. McElroy's resignation was also accepted with regret, and the Council placed on record their appreciation of his services and untiring devotion to its interests. Mr. A. L. C. Fell and Mr. John Barnard were elected members of the Council.

TRAMWAY EMPLOYEES' WAGE REDUCTION.

The National Joint Council for the Tramway Industry notified its members on April 20 that in view of the cost of living figure for April having fallen to 82 per cent. over that of August, 1914, reductions would be made in wages on and from the commencement of the first full pay period in May, 1922, as follows—Employees aged 18 and over, 2s. per week (making a total reduction of 10s. per week); employees under 18 years of age, 1s. per week (making a total reduction of 5s. per week).

An adjustment was also made at the same date on the sliding scale in respect of youths between 14 and 19 years of age, in accordance with the agreement of February 15, 1922. As this agreement provided for a revision at the rate of 3d. per week for every five points, rise or fall, in the cost of living from 100 per cent. as a datum figure, the reduction was at the rate of 9d. per week from the following scale—

Age.	Basic	Bonus.	Total.
14—15	10s. 0d.	5s. 0d.	15s. 0d.
15—16	12s. 0d.	5s. 0d.	17s. 0d.
16—17	14s. 0d.	5s. 0d.	19s. 0d.
17—18	18s. 6d.	5s. 0d.	23s. 6d.
18—19	24s. 0d.	5s. 0d.	29s. 0d.

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FINANCIAL REPORTS AND MEETINGS.

ROCHDALE TRAMWAYS DEFICIT.—There was a loss of £19,500 on Rochdale Corporation tramways last year.

MIDDLESBROUGH TRAMWAYS DEFICIT.—There was a deficit of £26,000 on the working of Middlesbrough Corporation tramways for the year ended March 31, 1922.

ENGLISH ELECTRIC COMPANY, LIMITED.—The directors recommend a dividend of 5 per cent. on the ordinary shares for 1921, as compared with 8 per cent. for the previous year.

CITY OF BUENOS AYRES TRAMWAYS COMPANY (1904).—A dividend of 1s. 3d. per share (being at the rate of 5 per cent. per annum), less tax, for three months ending March 31 last, has been declared.

BEXLEY AND DARTFORD TRAMWAYS.—There is an estimated deficiency on the Bexley Urban District Council Tramways and Dartford Light Railways for the year ended March 31, 1922, of £2,887.

HADFIELDS, LIMITED.—A final dividend of 6d. per share has been declared, making with the interim dividend 5 per cent., free of tax, for the year. The dividend for the previous year was 5 per cent., and in the preceding year it was 10 per cent.

BURY TRAMWAYS LOSS.—The draft annual balance sheet of Bury Corporation Tramways shows a loss on working during the last twelve months of £12,461 on the Bury sections, £1,943 on the Radcliffe section under the first agreement, and £913 17s. under the second agreement.

RANGOON ELECTRIC TRAMWAY AND SUPPLY COMPANY.—A dividend has been declared of Rs. 1 per share on the ordinary shares, free of tax, to shareholders domiciled in India or Burma, making Rs. 1½ for the year. A sum of £30,000 is placed to reserve for renewals, and £12,969 is carried forward.

CARDIFF TRAMWAY RECEIPTS.—The general manager of Cardiff Corporation Tramways (Mr. R. L. Horsfield) has reported that for the past year the passenger receipts on the tramcars were £277,835, a decrease on the previous year of £13,054. The number of passengers decreased by 2,525,232 to 40,114,675. There was also a decrease in the wages bill of £5,651, which brought it to £157,678 for the year. The fall in income he could only account for by the depression in trade and the interference with the ordinary traffic by reason of the reconstruction of the track.

GREENOCK AND PORT GLASGOW TRAMWAYS COMPANY.—The annual report shows that after providing for all expenses chargeable to revenue, including £2,377 for mortgage interest, amounts payable under agreements with corporations amounting to £1,479, and setting aside £15,675 for renewals, there is a surplus on year's working of £7,482, making, with £410 brought forward, £7,893, which directors propose should be appropriated as follows—To sinking fund for loan redemption, £1,796; to reserve, £1,000; to dividend of 5 per cent. on preference shares for the year to December 31; balance to be carried forward, £1,597.

BRADFORD CORPORATION TRAMWAYS.—The receipts of Bradford Corporation tramways for the year ended March 31, 1922, were £709,900, as compared with £702,108 for the previous year, an increase of £7,792. The following figures were recently presented to the committee, those in parenthesis being for the year 1920-21—Average receipts per car mile, 27·78d. (26·54d.); mileage run—tramways and railless 6,132,403 (6,347,404); passengers carried—tramways and railless, 79,620,044 (88,865,557); journeys per annum per head of population (based on 370,000 population), 215 (240); number of days worked 356 (364)—the decrease of eight days being due to the coal strike last year; the number of parcels carried, 771,448 (740,699).

METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED.—The annual meeting was held in London on April 5, Mr. J. Annan Bryce (the chairman) presiding. Mr. Bryce said the profit available for the year was £440,342, or nearly £40,000 in excess of that of 1920, which he thought was satisfactory in view of the depression in trade. Orders received were considerably fewer than in the preceding year, but the shops were kept fully employed owing to the number of orders remaining unexecuted at the beginning of the period. As a result of the year's operations, they were enabled, after allocating £35,000 to special depreciation and raising the general reserve to £400,000, to increase the carry forward by £33,991. The output of the year had been the largest during the history of the company, exceeding by 35 per cent. the output of 1916. Mr. Bryce mentioned that it had been decided to invite Mr. Douglas Vickers, head of the great organisation which bore his name, to take the vacant place on the board of directors.

ARGENTINE TRAMWAYS AND POWER COMPANY.—The report for year to September 30, 1921, states that the gross receipts of the tramway department were 690,657 dollars (paper), an increase of 128,271 dollars (paper). Gross receipts of light and power department were 336,314 dollars (paper), an increase of 66,447 dollars (paper). Net receipts from operation totalled £28,028, an increase of £5,442. Profit on exchange was £255. Including interest and transfer fees, the revenue was £28,559, against £26,893. After charging interest and sinking fund on debenture stock and London expenses, and transferring £5,000 to reserve for renewals, there remains £10,245. A scheme of arrangement approved by holders of preference and ordinary shares on March 22 provides, *inter alia*, that £18,323 standing to the credit of revenue account at September 30, 1920, shall be carried to reserve and shall not be treated as profit available for dividend. Subject to scheme being approved by the Court and to £50,000 of five per cent. debenture stock, subscriptions for which have been conditionally promised, being allotted, the directors propose dividend at the rate of 5 per cent. (less tax) on preference shares in respect of the past year, carrying forward the balance, subject to income tax and corporation tax (if any).

BRUSH ELECTRICAL ENGINEERING COMPANY.—The annual meeting was held in London, Mr. E. Garcke (chairman) presiding. The chairman said the directors were glad to be able to report a further substantial improvement in the general prosperity of the company. Including the amount brought forward from the previous year, they had a total profit balance of £374,585. It was proposed to apply to deprecitation of buildings, plant, patents, etc., £15,000, to pay a further 4 per cent. interest on the prior lien participating debenture stock, and to add to the reserve fund £73,190, bringing it up to £150,000, and to pay a dividend on the ordinary shares of 15 per cent. for the year. They were fortunate in entering 1921 with a good order book, and despite the coal strike the output for the year was the largest in the history of the company. Referring to the development of the company's Brush Ljungstrom turbo-generator plant, Mr. Garcke said the merits of the design were now generally recognised, and evidence of the economies which it effected in steam consumption continued to accumulate. The company's output in transformers was also a record for the year, and the products of this department appeared to have given general satisfaction to buyers, both as regarded efficiency and reliability. On the rolling stock side the output was well maintained. They were well equipped for securing their fair share of any business offering, not only as regarded tramcars and trucks and motor omnibus bodies, but also of railway rolling-stock.

LEEDS CITY TRAMWAYS.

Alderman R. A. Smithson, Chairman of the Leeds City Tramways, submitted to the Tramways Committee on April 24 a financial statement of the results of working of the Leeds City Tramways for the year ended March 31, 1922. A summary of the results is appended—

	Year ended March 31, 1922.	Average per car mile. 1922.	Year ended March 31, 1921.	Average per car mile. 1921.
	£	d.	£	d.
Traffic revenue	953,906	24·546	989,690	23·340
Sundry revenue	5,797	·149	5,947	·140
Total revenue	959,703	24·695	995,637	23·480
Working expenses	702,250	18·070	729,345	17·200
Gross profit	257,453	6·625	266,292	6·280
Add Interest on Investments	15,978	·411	26,895	·634
Bank Interest	177	·004	2,423	·57
From Unemployed Grants Com. ...	2,451	·063	...	...
	276,059	7·103	295,610	6·971
Against which is charged—				
Loan charges	132,164	3·401	128,337	3·027
Do., Sovereign St. estate	3,818	·098	3,818	·090
Do., Burmantofts property	135	·003	135	·003
Revenue contribution to capital outlay	1,561	·040	2,059	·049
Rental of Morley Light Railway ...	2,701	·069	2,596	·061
Income Tax	38,385	·988	52,832	1·246
Permanent way renewals	140,561	3·617	100,211	2·363
	319,325	8·216	289,988	6·839
Surplus or deficit...	—43,266	—1·113	+5,622	+·132

The total receipts, miles run, etc., are appended—

	Year ended March 31, 1922.	Year ended March 31, 1921.	Increase or Decrease.	Per Cent. of Increase or Decrease.
Total receipts	959,703	995,638	—35,935	3·609
Miles run	9,326,755	10,176,874	—850,119	8·353
Passengers carried	129,707,979	138,621,331	—8,913,359	6·430
Receipts per mile	24·695d.	23·480d.	+1·215d.	5·170
Average fare paid per passenger ...	1·741d.	1·696d.	+·045d.	2·653
Population served	557,000	557,000	...	...
Number of times population carried ...	233	249	—16	6·426
Amount paid per head of population ...	33/9	35/2	—1/5	4·028

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TRAMWAY AND LIGHT RAILWAY NOTES.

BARROW-IN-FURNESS.

REDUCED FARES.

A revised scale of fares and stages has been approved by the Town Council. Penny fares are introduced, and higher fares are proportionately decreased. The manager (Mr. J. R. Groves) estimates that the approximate reduction in revenue for the year will be £1,581, and the approximate increase in expenses £1,334, a total of £2,915.

BIRMINGHAM.

THE CORPORATION BILL.

The Birmingham Corporation Bill, which includes clauses relating to railless trolley vehicles, tramways and omnibuses, came before the Local Legislation Committee of the House of Commons, and the clauses alluded to were unopposed. Mr. Tyldesley Jones, K.C., said the Corporation were faced with the question whether they were going to spend a large sum of money on reconstructing the Nechells tramway route, or were going to provide an alternative method of transport. The promoters asked that they should be authorised to run trolley vehicles over the route. Mr. Erskine, for the Ministry of Transport, said the proposed trolley vehicles were more of the nature of tramways than motor omnibuses, and the Ministry thought that the promoters, in seeking to extend the trolley vehicle system, should proceed by Provisional Order. Mr. Tyldesley Jones said the Corporation sought powers to run trolley vehicles anywhere. He suggested that the powers under the Bill should be confined to the routes on which the Corporation were running tramways to-day, and that, in the event of powers being sought to run trolley vehicles elsewhere, they should have to apply for powers by Provisional Order. Mr. Erskine assented. Mr. A. Baker (general manager of the Corporation tramways) gave evidence in support of the tramway clauses. He stated that the cost of reconstructing the Nechells route was estimated at £90,000. The tramway clauses were agreed to.

BLACKBURN.

NO CHEAPER FARES.

Two members of the Town Council asked for a reduction of 1½d. tramway fares to 1d., on the ground that wages had been reduced, as well as the price of steel. Alderman C. Higham (chairman of the Tramways Committee) replied that the reductions had not made the lowering of fares justifiable.

BRADFORD.

PENNY FARES NOT FAVOURED.

Mr. R. H. Wilkinson, general manager of the Corporation tramways, reported against a proposal to reintroduce penny fares, and stated that the present 2d. minimum is the main source of revenue. "It brings in 57 per cent. of the total passenger receipts," he said, "and any alteration thereto would seriously jeopardise the stability of the undertaking."

BRISTOL.

TRAMWAY COMPANY'S BILL.

The Bill promoted by the Bristol Tramways and Carriage Company came before a Select Committee of the House of Commons on May 2. Its purpose is to extend the time limited by an Order of the Minister of Transport for the compulsory purchase of lands which the company were already authorised to acquire; also to extend the time limited by the Order of 1921 for the construction and completion of certain tramways. Mr. W. G. Verdon Smith (managing director) gave evidence. The preamble was found to be proved, and the Bill passed the Committee.

BURNLEY.

TRANSPORT MINISTRY AND "REVERSED" STAIRS.

Councillor Eastwood (vice-chairman of the Tramways Committee) has reported that he and the general manager (Mr. H. Mozley) interviewed representatives of the Ministry of Transport and urged the withdrawal of the Ministry's prohibition of "reversed" staircases on new tramcars. The Ministry intimated their intention of adhering to their prohibition.

DEARNE VALLEY.

LIGHT RAILWAY SCHEME.

The Dearne Valley light railway scheme was alluded to at a meeting of Wombwell Council, when the clerk stated, in reply to a question, that the Council was pledged to support the project. The chairman explained that the scheme received much opposition in its Parliamentary stages, and since that time the work had been held up by the high cost of materials. As soon as things became normal he presumed that the work of construction would proceed.

DONCASTER.

TRACK DOUBLING.

The Corporation have decided to apply to the Ministry of Transport for sanction to borrow £2,150 for the doubling of the single tramway track from the loop in Arksey Lane to a bend in High Street on the Doncaster side of the Bentley Mill Bridge.

DUNDEE.

PROPOSED TRACK RECONSTRUCTION.

The general manager and engineer of the Corporation tramways (Mr. W. T. Young) has reported that an expenditure of £59,000 on track reconstruction and rail hardening is desirable. The matter has been referred to a special committee.

EDINBURGH.

PRINCES STREET CENTRE POLES—ROUTE EXTENSIONS.

In the House of Commons on April 10, Mr. Neal stated that he had received the report of the inquiry carried out by the Ministry of Transport into tramway traction at Edinburgh. He had decided to adopt the recommendation that the request of the Corporation for permission to put up centre poles to carry the overhead electrical equipment in Princes Street and to alter the position of the rails on the northern side of the street should be granted. The report, Mr. Neal added, would be published if desired. The Tramway Committee are consulting the Director of the College of Art and his colleagues on the question of the decorative design to be used on the one-piece tapering poles which will be erected in Princes Street, and as to the most suitable type of lamp to be suspended from the poles. The Corporation are to apply to the Secretary for Scotland for a Provisional Order under the Private Legislation Procedure (Scotland) Act 1899, for power to construct and maintain tramways, to acquire lands for improvements, and for other purposes. Among the estimates prepared for the proposed new undertakings are the following—In connection with the tramways, £105,144; for conversion to electric traction of the remaining sections of the Corporation tramways, £110,644; for tramway equipment, cars, other rolling stock, and depots, £314,367. Seven new tramway routes are projected, and are expected to be completed within seven years. Power is also sought in the Order for the transfer to the Corporation of the tramway and electrical undertakings of the Musselburgh and District Electric Light and Traction Company Limited.

GATESHEAD.

NEW CARS.

The Gateshead and District Tramways Company recently put into service five new single-deck cars of very roomy proportions and pleasing design. It is understood that seven additional double-deck top-covered cars will shortly supplement the company's rolling stock.

GLASGOW.

OFFER FOR PAISLEY SYSTEM—CORPORATION ORDER.

The Corporation Sub-committee on Tramways Extensions decided on April 26 by five votes to four to recommend the Tramways Committee and the Corporation to offer £250,000 for the tramway undertaking of the Paisley District Tramways Company. An amendment was that an offer of £200,000 should be made. The committee on May 3, however, decided to recommend a continuance of consideration of the proposal to purchase the undertaking until a special meeting of the committee on May 19. In the meantime the general manager (Mr. J. Dalrymple) was instructed to arrange that all members of Glasgow Tramways Committee should be given facilities to inspect the Paisley undertaking. At a special meeting of Glasgow City Council approval was given to the Glasgow Corporation (Tramways, etc.) Order 1922. The Order seeks power, among other things, to authorise the Corporation to take over and work the tramway undertaking of the Airdrie and Coatbridge Trustees, acquired by the Corporation at a cost of £82,250, and to acquire further borrowing powers for tramways.

HALIFAX.

NEWSPAPERS ON THE CARS.

The Tramways Committee is entering into an agreement with the local Newsagents' Wholesale Supply Company for the carriage of newspapers on the cars at a charge of £80 per annum.

HASTINGS.

PENNY FARES.

Hastings Tramways Company, Limited, introduced a number of penny stages on their system on Sunday, April 23, and withdrew the 1½d. stages.

HUDDERSFIELD.

NEW OMNIBUS SERVICE.

The Corporation opened its new omnibus service from Honley to Holmfirth and Holmebridge on April 15, when the members of the Huddersfield Tramways Committee, Mr. A. A. Blackburn, the general manager, and members of the tramway staff travelled by the new omnibus from the tramways office to Holmfirth, where they were joined by the chairman, Councillor G. H. Tinker, and other members of the Holmfirth Urban District Council. Councillor Tinker, in welcoming the representatives from Huddersfield, said that they were inaugurating a service which was bound to be a benefit to both communities. The new omnibuses of the Huddersfield Corporation were a credit to Huddersfield, and they provided an excellent means of seeing the beautiful country through which

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they passed. They all regretted that the late chairman of the Tramways Committee (Alderman Sellers) had not lived to see the inauguration of the service. The new omnibuses have been supplied by Karrier Motors, Limited, of Huddersfield.

HULL.

LETTER BOXES ON CARS.

The Tramways Committee propose to make an experiment in placing letter boxes on cars on two routes for about two months. A suggestion has been made that the Post Office should make a payment of £30 per annum while the experiment is in operation.

LIVERPOOL.

PRESENTATION TO VETERAN TRAMWAY MAN.

A presentation was recently made at the Lambeth Road Carriage Works of the Corporation Tramways to Mr. Robert Bulman on the occasion of his retirement after over 40 years' service with the city tramways, including 15 years with the old tramways company. The general manager (Mr. P. Priestly) handed to Mr. Bulman a gold watch, chain and pendant and gold sleeve links, with a silver chain bag for Mrs. Bulman. Mr. Priestly referred to the fact that Mr. Bulman had had the unique experience of assisting in the building of practically every type of tramcar since their inception in this country.

LLANDUDNO.

ELECTRIC RAILWAY STRIKE ENDS.

The strike of employees of the Llandudno and Colwyn Bay Electric Railway Company, which commenced on February 18, has been amicably settled as a result of the intervention of a representative of the Labour Ministry.

LONDON.

THROUGH SERVICES—ROYAL COMMISSION AND TRAMWAYS.

The tramway systems of the London County Council and the London United Tramways have now been linked up at Hammersmith by the laying of a short length of track in the Broadway. The new service under the through-running agreement between the two undertakings has commenced, and the route from the borough of Southwark to Kew affords one of the longest through services by tramway in London. Starting from the Hop Exchange, near London Bridge, cars run by way of Wandsworth, Putney, across Putney Bridge, through Fulham Palace Road, and from Hammersmith over the London United Company's line to Kew, with a corresponding return service. The following alterations in the London United Tramways service have been made—The Hounslow and Hammersmith service is diverted to Shepherd's Bush; the Shepherd's Bush and Kew service is projected to Brentford (G.W.R. Station) on weekdays (Mondays to Fridays); the Hampton Court service, however, continues to run as hitherto to Hammersmith. The following further alterations also came into operation on May 2—The Tooting and Hampton Court service does not run beyond Wimbledon Station; the London County Council Tramways have introduced a new service from the Embankment *via* Merton to Wimbledon Station (about ten miles), connecting at that point with the London United Tramways service Kingston, Hampton Court, etc. On Mondays to Fridays, the mid-day fare is 2d. all the way between the Embankment and Wimbledon Hill. On the Kew Bridge through service, mid-day passengers can travel at 2d. between Central London and Hammersmith Broadway, and thence, paying ordinary fare, 3d. to Kew Bridge. At the resumed sitting of the Royal Commission on London Government on April 25, evidence was given by Sir Herbert Nield, K.C., M.P., chairman of the Parliamentary and County Building Committees of Middlesex County Council. Mr. Robert Donald, a member of the Commission, questioned Sir Herbert with regard to the lease of Middlesex Tramways to the Metropolitan Electric Tramways Company, and suggested that it had resulted in a loss to the county. Witness did not agree.

MANCHESTER.

FARE REDUCTION—CONTRIBUTION TO RATES.

The City Council have confirmed the Tramway Committee's recommendation that a reduction be made in fares by increasing the length of the existing penny stages. The committee originally had before them a proposal by the general manager (Mr. J. M. McElroy) that the reduction should be made on two routes only, as an experiment. Mr. McElroy suggested that the penny stages should be lengthened from a mile and a quarter to a mile and a half for a period of two months. It was ultimately decided, however, that the trial should apply to all routes. If the test proves successful, tramway fares in Manchester will revert to the level at which they stood before the last increase was made. On the journey from the city to Heaton Park, Middleton or Withington, for instance, there will be a reduction of a halfpenny on the present fare. The accounts presented to the committee showed an approximate expenditure for the year ended March 31 last of £1,994,551, or £43,449 less than the estimate. The estimated revenue for the current year was £1,894,495—a reduction on last year, in view of the probable loss on the new fares, of approximately £100,000. The Tramways Committee decided to allocate £50,000 to the relief of rates.

NOTTS AND DERBY.

THE TRAMWAY COMPANY'S BILL.

The Nottinghamshire and Derbyshire Tramways Bill came before the Unopposed Bills Committee of the House of Commons on May 3. The Bill seeks powers for the construction of additional tramways intended to link up the main system of the company with the Ilkeston tramways. It was also proposed to reconstruct part of the tramways so that the whole system would be run on standard gauge. The cost of new construction would be £72,000, for new cars and equipment £38,000, for the completion and purchase of tramways £19,000, and for the purchase of the Ilkeston Tramways £80,000. After formal evidence, the Bill was passed for third reading.

SALFORD.

THE CHARGE FOR ENERGY TO THE TRAMWAYS.

At a meeting of Salford Ratepayers' Association on May 2, Mr. F. Marsh, one of the elective auditors, complained that the Electricity Committee charged the tramways 2d. per unit for current. In the past year the current used for running the cars cost £82,614, and if the charge were reduced by one halfpenny per unit the Tramways Committee would make a surplus of £20,000 per year more. Reference to the matter was made at a meeting of the Corporation on May 3, when the chairman of the Electricity Committee denied that they were exploiting the Tramways Committee. If the latter felt aggrieved, let them have a friendly arbitration. Councillor F. Jones said he was prepared to prove that the charges were lower in Manchetsr than in Salford.

ST. HELENS.

EXTENSION OF TRACK.

The Tramways Committee have decided to lay a double line of track from Croppers Hill to the borough boundary and to relay the track in Church Street. For these purposes application is being made for a loan of £40,000.

SHEFFIELD.

ECONOMY EFFECTED BY EMPLOYEES' EARLY HOLIDAYS—ECCLESALL EXTENSION.

By means of reductions in salaries and curtailing the programme of work of committees, the Sheffield Corporation on April 12 took steps which are estimated to effect a reduction in the rates of 1s. 9d. in the £. The recommendations were made by the Economy Committee, presided over by Sir Wm. Clegg, who is also chairman of the Tramways Committee. Referring to the tramway proposals, Sir William said that there would be a saving of thousands of pounds by the men taking their holidays now instead of later. This step would obviate the necessity for calling in extra men to take their places. In reply to a complaint of the alleged bad state of the tracks, coupled with the taking of £5,000 from the tramways fund, Sir William stated that £50,000 had been reserved for renewals. Regarding the Corporation officials, he said they had consented to a reduction for two years, after which they would revert to their original position, subject to what the Council of that date might say. The Economy Committee, he added, was going to continue their work, and he invited suggestions.—The Ecclesall extension of the Corporation Tramways has been put into use, and cars now run beyond the old terminus at Banner Cross to the top of Millhouses Lane (Silver Hill). The extension serves a new housing area.

SOUTHPORT.

TRAMWAYS AND OMNIBUS PROPOSAL.

A special sub-committee of the Tramways Committee which considered the advisability of running motor omnibuses, reported that it is undesirable to substitute omnibuses for the present tramway service, owing to the heavy expenditure required for omnibuses, the extra capital and maintenance cost on the roads as compared with the present maintenance of the tramway track, and the loss to the electricity undertaking in revenue. There were no districts in the borough, the sub-committee added, where it would at present pay to run omnibuses as an adjunct to the tramway system. The Town Council deferred consideration of the report for a month.

SUNDERLAND.

TRAMWAY STRIKE ENDED.

A settlement was effected on April 21 of the strike of employees of the Sunderland District Electric Tramways, Limited, which had been in progress for eleven weeks. As the result of the intervention of Alderman Robert Richardson, M.P. for the division, a conference took place between representatives of the company and of the employees. It will be remembered that the cause of the strike was the decision by the company to effect a wage reduction in excess of that provided for by the National Agreement. In view of the serious decrease in their revenue, they contended that they were unable to continue to pay the then existing wage bill, and sought a reduction which, in the case of the higher paid men, amounted to 10s. a week. At the conference referred to an agreement was reached that the men accept a reduction of 5s. per week, but that no further decrease take place when the national wages scale was revised at the beginning of May.

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WEST HAM.

MANAGER'S REPORTS ON FARE QUESTION.

Mr. M. L. Slattery, general manager of West Ham Corporation Tramways, recently presented two reports to his committee—one on the operation of the 2d. maximum midday fare and the other on fares generally, to both of which brief reference was made in our issue of April 29. In the first report he gives statistics which show that after allowing for assumed "economic" loss, due to the present condition of trade, there was an increase in the number of 2d. passengers of 615,697, and a decrease in the number of 3d. and higher of 788,789 for the 33 weeks to March 30 last, representing a fall in revenue of £6,464, equivalent to £10,085 for a complete year. It cannot be claimed, Mr. Slattery adds, that the operation of the 2d. midday fare has been the success the Council anticipated. In his report on fares generally, the manager cites the falling off in traffics on various tramway and railway systems, and remarks that it appears that this decrease is universal, and must be primarily attributed to the present economic conditions. He is strongly of opinion that any curtailment or concessions in fares at West Ham could only result in a deficiency which would have to be made up from the rate account. Having regard to the financial position of the undertaking, and the uncertainty of the future, he cannot recommend any alteration in fares at the moment.

WOLVERHAMPTON.

REDUCTION OF MINIMUM FARE.

The Tramways Committee recommended that the 2d. minimum fare be reduced to 1½d., and the Town Council confirmed the recommendation. The tramways general manager and engineer (Mr. C. O. Silvers) estimated that were the 2d. minimum retained there would be a credit balance of £8,438, but with the 1½d. minimum there would be a deficit of £3,562. The committee considered that they were justified in this recommendation only by the overriding necessity to make every possible contribution to a further fall in the cost of living.

CONTRACTS AND ORDERS.

Aberdeen Town Council propose to purchase two 6-ton Leyland motor lorries at £1,130 each.

Tilling-Stevens Motors, Limited, are supplying a double-deck omnibus to Blackpool Watch Committee.

Manchester Corporation have accepted the tender of Walter Scott, Limited, for steel girder tramway rails.

Cravens Railway Carriage and Wagon Works have an order from Edinburgh Corporation for tramcar top covers.

Salford Electricity Committee have ordered from the Metropolitan-Vickers Electrical Company, Limited, two 6,000-volt switch cubicles.

Sheffield Corporation proposes to ask for sanction to borrow £30,000 for the construction of a garage for electric vehicles and the equipment of the cleansing depot.

Newport (Mon.) Tramways Committee have accepted the following tenders—Messrs. Wettern Brothers, for 300 tons of setts; Messrs. Walter Scott, Limited, Leeds, for 250 tons of rails.

Edinburgh Town Council have accepted the tender of the Metropolitan-Vickers Electrical Company, Limited, for motors and of the English Electric Company, Limited, for controllers.

Keighley and Leyland Omnibuses.—Keighley Tramways Committee have recommended that two of the omnibuses at present on hire from Leyland Motors, Limited, be purchased at £1,575 each.

Bradford Tramways Committee have accepted the tender of Millars' Timber and Trading Company, for the supply of a "truc-tractor" at £505, and three trailer-tipping wagons at £12 10s. each.

Wolverhampton Electricity Committee have accepted the tender of the Stirling Boiler Company for two 40,000 lbs. water tube boilers, and that of the Underfeed Stoker Company, Limited, for four mechanical stokers.

Islington Cleansing Committee have recommended the purchase of four 2½-ton electric vehicles for refuse collection from the General Vehicle Company, Limited, at a total cost of £5,200, and a 4-ton petrol lorry from Commercial Cars, Limited, at a cost of £877.

Welsh Highland Railway.—Messrs. M'Alpine have secured the contract for the construction of the Welsh Highland Railway for a sum of nearly £60,000. It is expected that the section between Dinas and Beddgelert will be completed by Whitsuntide, and that from Beddgelert to Portmadoc by July.

Calcutta Electricity Supply Corporation is reported to have placed several contracts under a Trade Facilities Act guarantee to the amount of £250,000. Among the contracts are the following—English Electric Company, Limited, 15,000 kw. turbo-generator; Stirling Boiler Company, Limited, boilers; British Thomson-Houston Company, Limited, transformers; W. T. Henley's Telegraph Works, cables.

Johannesburg Municipal Council have accepted the tender of Hadfields, Limited, for the supply of 500 standard tyres for tramway cars at £4 4s. 3d. each (total value, £2,106 5s.), and of the Continental and Colonial Commercial Company, Limited (lowest), for the supply of 20 rolled steel tyres for pony wheels of bogie tramcars, at £2 17s. 6d. each (total value, £57 10s.).

Metropolitan-Vickers' New Zealand Order.—A Reuter message from Wellington, New Zealand, states that the Government has accepted the tender of the Metropolitan-Vickers Electrical Company, of Manchester, amounting to £30,764 for the supply of switch gear for the Mangahao hydro-electric installation, which will provide the Wellington district and city with electrical power. The installation will have the highest electrical pressure in Australasia and the best and most reliable controls were necessary. The lowest tender received was one for £24,666 from America.

Sandberg "Insitu" Rail Hardening Process.—The Scholey Construction Company, Limited, 56 Victoria Street, S.W.1, have secured a contract for the "Insitu" treatment of 2¼ miles of track for the Newcastle Corporation Tramways. They are also carrying out extensive contracts for the Wallasey, Liverpool, Leeds and Hastings tramways. Messrs. Elder Smith & Company, Limited, of London and Sydney, have obtained a contract for the "Insitu" treatment of three miles of track for the New South Wales Government tramways in Sydney. Orders received up to date include the treatment of 150 miles of tramway track on the following undertakings—Croydon, Bournemouth, Glasgow, Leeds, Manchester, Sheffield, Liverpool, Newcastle, Birmingham, Metropolitan Electric, Bristol, Derby, Reading, S. Shields, Bolton, London County Council, Edinburgh, Bury, Birkenhead, Wallasey, Bradford, Cardiff, Hastings, Sydney (N.S.W.), London United, Paris.

PERSONAL.

Lieut.-Colonel J. A. Cole, deputy chairman and managing director of Humber, Limited, has been elected president of the Society of Motor Manufacturers and Traders, in succession to Sir Alfred Mays-Smith.

Major-General Sir Frederick H. Sykes, G.B.E., K.C.B., C.M.G., has been appointed a director of the Underground Electric Railways Company of London, Limited, the London General Omnibus Company, Limited, and the Associated Equipment Company, Limited.

Mr. R. H. Pitts, O.B.E., has been appointed to act as staff officer for the London Underground Companies. His duties in this connection will be in addition to those he has previously filled as Secretary of the Joint Standing Committee of the grouped companies.

Mr. H. H. Lancaster, executive officer of Blackpool Corporation Tramways, has been appointed traffic superintendent of the undertaking, in succession to Mr. Charles I. Baker, now manager of Ashton-under-Lyne Corporation Tramways. There were 58 applicants for the Blackpool vacancy.

Mr. C. I. Baker entered upon his duties as manager of the Ashton-under-Lyne Corporation Tramways on May 1. Prior to his departure from Blackpool he was presented by Councillor H. Brooks (chairman of the Electricity and Tramways Committee), on behalf of the Electricity and Tramway Employees' Institute, with a cheque. The tramway employees have presented Mr. Baker with an oak grandfather's clock.

Councillor H. Salmon, the manager of the Expanded Metal Company, whose works are at West Hartlepool, has been appointed chairman of the West Hartlepool Tramways Committee in place of Alderman R. Martin, who, owing to failing health, resigned from the Tramways and Electricity Committee. Alderman R. Martin, J.P., who has been a member of this local governing body for the last 23 years, occupied the chief civic chair for two years, 1911 and 1912, and held the chairmanship of the Tramways Committee for nine years.

Alderman Sir William E. Clegg, J.P., chairman of Sheffield Corporation Tramways and Motors Committee, received the Freedom of the City on April 21—his seventieth birthday—in recognition of long and distinguished services to Sheffield. As was noted in our issue of March 11 last, it is principally in connection with the development of the tramways that Sir William's work for the city is known. He was appointed chairman of the committee when that body was formed in 1896, and during his term of office the motor omnibus system was successfully inaugurated.

Mr. E. S. Rayner, general manager of Hull Corporation Tramways, was recently offered by the committee a salary of £1,200 per annum as from July 1 next, rising by three annual increments of £100 to £1,500, such salary not to carry any bonus. Mr. Rayner, whose present basic salary is £800 with bonus, declined the offer. It will be recalled that he was one of the three candidates recently interviewed by Manchester Tramways Committee with a view to the appointment of general manager in that city, and that the position was filled by the appointment of Major H. Mattinson.

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Mr. Joseph A. Bromley, general manager and engineer of Keighley Corporation tramways, has been appointed general manager of the York Corporation tramways at a salary of £600 per annum, in succession to Mr. J. W. Hame, resigned. Mr. Bromley gained much of his experience on the Leeds undertaking, where he held the post of chief assistant rolling-stock superintendent before going to Keighley at the beginning of last year. Here he set himself to improve the services of both tramcars and railless trolley vehicles, introducing the queue system, and subsequently arranging motor omnibus services on the Oakworth and Sutton routes. His knowledge of railless traction will, of course, find scope at York, where a system of this type was introduced over 12 months ago.

Mr. J. B. Hamilton and His World Tour.—Mr. J. B. Hamilton, general manager of Leeds Corporation Tramways, whose return from a tour round the world was noted in our issue of April 15, mentioned in a local interview that, in the course of his travels, he had seen all the systems of transport in the Northern Hemisphere. Everything pointed to a still greater development of electric traction. "Railless cars," he said, "are being largely used in Shanghai, where they are to be still further exploited, and the same form of traction is extending in various parts of America." New York had an excellent service of motor omnibuses, the vehicles being of the same type as those running in London. In America generally, he said, the tramways are suffering from the same disabilities that afflict British concerns, especially high costs of operation, which have gone up in an even greater ratio than in this country. In the United States some of the tramway systems with fixed tariffs were in the hands of receivers. The one place above all others where there has been no development in transport was Pekin. The streets were planned some 500 years ago, he believed, and they were on lines which would delight the hearts of our modern city engineers, but the methods of transport were the same as when the place was laid out, and probably for 500 years before that.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Axle and spring connecting means for heavy motor vehicles, etc. (9,815)—V. G. Barford and J. I. Thornycroft and Company, Limited.
Electric motor control (9,982)—British Thomson-Houston Company, Limited, and C. T. Hanna.
Trailer brake connection for vehicles (9,595)—C. F. Cleaver.
Current collectors (9,769)—N. Clough.
Systems of electric traction and suspension means for overhead conductors therefor (9,770)—N. Clough.
Machine for dressing rails (9,640)—J. W. Eunson and Woods Gilbert Rail Remodelling Company, Limited.
Motor vehicle bodies (10,018)—T. Jones and H. Smith.
Anchoring conductor rails for tracks (9,579)—W. H. Meyrick.
Rail joint (9,492)—A. R. Pearson.
Transmission mechanism for motor vehicles (10,072)—L. D. Smith.
Bodies of motor vehicles (10,238)—Bucks Mechanical Transport, Limited, and H. J. Wood.
Tramcars, road vehicles, etc. (10,243)—W. P. Durtnall.
Locking device for steering mechanism of motor vehicles (10,289)—G. FitzGibbon.
Motor vehicles (10,636)—R. Harrison and Son, Limited, and W. B. Thomas.
Fishplate for tramway rails (10,161)—F. O. Harwood.
Lifting jacks (10,134)—G. A. Mortier.
Controlling mechanism of electrically propelled vehicles (10,220)—P. A. H. Mossay, Mossay and Company, Limited, and Ransome Sims and Jefferies, Limited.
Steps for omnibuses, tramcars, etc. (10,701)—W. C. Pengelly.
Driving mechanism of motor vehicles (10,248)—H. Singleton.

SPECIFICATIONS PUBLISHED

1920

Bodies of motor vehicles (33,657—*176,462*)—F. E. Pike.
Registering ticket punches (33,749—*176,464*)—F. Mathews and S. D. Black.
Tramcars and omnibuses (33,869—*176,466*)—J. A. Davenport.
Internal combustion engines for motor vehicles (34,438—*176,487*)—W. Fisher.
Transmission and brake mechanism of power propelled road vehicles (34,744—*176,514*)—F. W. Lanchester.
Steering devices for vehicle wheels (36,335—*176,563*)—S. Rawlinson.
Motor vehicles (33,487—*176,851*)—S. S. Guy.
Self-propelled vehicles (35,330—*176,890*)—R. Venzlaff, W. Von Mumm and A. Von Mumm.

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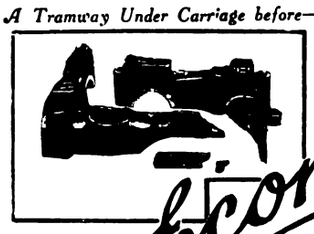
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Apparatus for printing and issuing tickets for fare systems (29,408—*177,191*)—Johnson Fare Box Company and A. J. Tanner.
Controlling apparatus for self-propelled vehicles (32,581—*177,563*)—C. Lamb, C. E. James and Leighton Motor Company.
Brake mechanism for vehicles (36,514—*156,588*)—M. Stringer, G. T. Bauder and A. E. Merkel.

1921

Bodies for motor road vehicles for carrying passengers (3,363—*176,601*)—E. F. Knight.
Axle boxes and bearings for tramcar vehicle wheel axles (10,833—*176,697*)—Hoffmann Manufacturing Company, Limited, and T. W. Cooper.
Lifting jacks (18,502—*166,138*)—A. Triou.
Motor vehicle suspension (23,353—*176,732*)—O. R. Dunnet.
Change-over apparatus for operating electrically propelled vehicles with different voltages (14,790—*163,998*)—Akt.-Ges. Brown, Boveri et Cie.
Fare systems and means used therewith (20,619—*167,482*)—A. J. Tanner.
Steering devices for motor road vehicles (391—*156,509*)—M. Birkigt.
Lubrication of motor vehicles (13,086—*163,044*)—B. H. Skelly.
Current collecting shoes (13,668—*177,433*)—J. D. Twinberrow and H. E. Gaze.
Tramcar seats and seat backs (2,346—*177,629*)—S. J. Aukland.
Motor vehicles (11,677—*177,722*)—A. E. Rouvier.

T.O.T. PHILHARMONIC SOCIETY.

SEVENTH EVENING CONCERT.

As is usual on such occasions the Central Hall, Westminster, was crowded on April 4 at the seventh evening concert of the Philharmonic Society, which is composed of members of the staff and employees of the Underground and allied companies. It may be stated for so young an organisation the advance shown in choir, military band and orchestra was most creditable. Their achievement is the more notable remembering that for combined rehearsals the members have to travel from all parts of the metropolis, and that many of them have spent a day at their work on train, omnibus and tramway car, or in the garages.

Another good sign is that the society is not above profiting from criticism. In commenting on their Victory concert given in the Royal Albert Hall, we suggested that notwithstanding the pleasure which is given to both audience and members alike by the engagement of first-class artistes, there would be greater satisfaction afforded if the three sections of the society sustained more items. This change was effected with success on this occasion, for out of a programme of thirteen numbers the society was responsible for nine.

The professional contributors were Miss Dorothy Greene (soprano), Mr. Edward Dykes (bass), and Mr. Norman Long (entertainer). They proved so popular that early in the second half of the programme encores had to be barred both for individual and collective numbers. The society's contributions were of great variety, and the high standard achieved in each reflected credit on the conductors and their forces. Besides taking part in the massed performances, the band were heard in Auber's overture, "Le Macon," and "Chimes of Joy," under the baton of Lieutenant J. Ord Hume, L.F., the latter item being his own composition. They also performed excerpts from Gounod, directed by Mr. A. Goodfellow.

The choir first appeared in selections from Coleridge Taylor's "Viking Song." With the orchestra they rendered Percy E. Fletcher's arrangement of "Reminiscences of Verdi." These items were conducted by Mr. Ewart Beech, who also took them through two numbers from "Les Cloches de Corneville." Planquette's opera is but rarely heard in these days, and the excerpts were done justice to. The first selection was the inaugural chorus, the soloists being Miss Queenie Thomas (Serpolette) and Mr. A. Tilston (Gobo). The second was the solos and duets sustained by Gaspard (Mr. A. Tilston), Marquis (Mr. G. J. Nicoll), Grenicheux (Mr. L. Russell), and Germaine (Miss Queenie Thomas). The selection closed with the two choruses, "Silent Heroes" and the ever popular "Ding, Dong."

Under the direction of Mr. C. F. Lambert the orchestra acquitted themselves with distinction in three pieces of a classical type. The first was Schubert's unfinished symphony in B Minor, the second Walford Davies's "Solemn Melody," and Handel's Largo, Mr. C. R. Rooney being at the organ. Towards the close of the programme Lord Stuart of Wortley, in the unavoidable absence of Lord Ashfield, the president, thanked the members for giving so delightful a concert, and complimented them and the conductors upon the improvement which was a feature of each succeeding entertainment.

The directorate were represented by Mr. H. A. Vernet, the Right Hon. Viscount Knutsford, Messrs. G. Watson, D. Duff, H. Kerr Thomas, Cater Scott, and H. E. Blain, C.B.E. Officials of the companies present were Messrs. F. Pick, W. A. Agnew, J. Ashby, P. V. McMahon, J. B. Mackinnon, A. Rozier, G. J. Shave, C. J. Spencer, J. F. Thomas, S. J. Webb, and H. Lansdown.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED April 9	April 16	April 23	April 30		1922. WEEKS ENDED April 8	April 15	April 22	April 29		AGGREGATE. Wks.	1921-22.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,782	3,668	3,461	3,622	...	3,274	3,346	3,298	3,299	...	47¾	165,674	− 14,376
Aberdeen Motor Buses	62	59	62	60	...	142	140	135	148	...	47¾	10,426	+ 8,757
Ayr Corporation	586	585	484	658	...	465	506	687	629	...	50	34,195	− 2,754
Barrow Corporation	872	863	792	927	...	578	594	733	575	...	4	2,482	− 976
Belfast City Tramways	12,632	12,953	12,495	13,214	...	11,986	12,142	12,409	11,967	...	4	48,504	− 2,790
Birkenhead Corporation	2,522	2,554	2,556	2,566	...	2,450	2,433	2,677	2,534	...	4	10,804	− 523
Birkenhead Motor 'Buses	508	478	529	609	...	543	682	811	668	...	4	2,899	+ 510
Birmingham Corporation	30,808	30,688	29,877	31,642	...	28,624	27,464	28,495	28,227	...	4	118,176	− 15,074
Birmingham Motor 'Buses	2,011	1,964	1,865	2,189	...	1,681	1,624	1,931	1,692	...	4	7,260	− 1,534
Blackburn Corporation	2,613	2,550	2,428	2,523	...	2,231	...	3,134	2,286	...	4	10,816	− 1,519
Bradford Corporation	13,745	14,599	13,518	15,108	...	13,157	13,622	15,232	13,775	...	5	58,814	− 3,513
Burnley Corporation	3,265	2,946	1,481	1,448	...	3,281	3,784	3,366	3,184	...	—	—	—
Burton-on-Trent Corporation ...	612	632	586	605	...	528	563	535	554	...	4	2,323	− 292
Bury Corporation	2,485	2,570	2,712	2,878	...	2,193	2,674	2,529	2,419	...	4¾	10,596	− 1,350
Chatham and District	1,793	1,713	1,525	1,642	...	1,515	1,602	1,887	1,538	...	17	25,108	− 2,646
Chesterfield Corporation	...	2,228	1,296	1,327	...	...	1,865	1,400	1,238	...	3	4,503	− 347
Derby Corporation	2,237	2,213	2,214	2,328	...	2,074	2,115	2,230	2,011	...	4	8,867	− 1,107
Dundee City	3,301	3,351	3,179	3,358	...	2,885	2,848	3,006	2,895	...	49¾	155,235	+ 2,450
East Ham Corporation	2,178	2,178	2,005	2,028	...	2,156	2,186	2,209	2,097	...	4½	9,046	+ 349
Edinburgh Corporation	...	...	...	...	...	11,565	11,919	11,856	11,371	...	50	619,407	− 44,325
Edinburgh Motor 'Buses	...	...	...	...	...	3,249	3,454	3,390	3,278	...	50	174,902	—
Glasgow Corporation	47,552	47,782	46,982	50,000	...	44,878	43,758	43,596	44,588	...	47½	2,140,981	− 17,750
Glossop (Urban Elec. Supply Co.)...	225	234	239	252	...	211	258	246	217	...	17	3,885	− 155
Halifax Corporation	3,655	3,988	3,950	4,103	...	2,375	3,887	5,166	3,994	...	3½	15,424	− 273
Halifax Motor 'Buses	93	97	104	102	...	32	59	66	57	...	3½	213	− 183
Halifax Railless Cars	...	...	...	...	...	33	41	84	52	...	3½	210	—
Huddersfield Corporation	5,080	5,033	5,006	5,657	...	4,930	4,986	6,510	5,012	...	5	26,378	− 1,063
Ilford U.D. Council	1,456	1,501	1,408	1,525	...	1,452	1,536	1,491	1,466	...	4½	6,252	+ 196
Ipswich Corporation	867	832	773	876	...	758	861	843	732	...	4	3,335	− 139
Isle of Thanet...	805	681	596	694	...	562	627	1,303	814	...	29½	18,720	+ 760
Kilmarnock Corporation	366	356	344	372	...	313	319	329	322	...	49¾	17,507	− 915
Leicester Corporation	6,401	6,385	6,103	5,761	...	7,172	7,540	7,464	7,257	...	17	122,109	+ 12,316
Liverpool Corporation	29,981	28,258	23,049	25,198	...	28,699	27,956	29,551	28,958	...	17	489,012	+ 13,811
London County Council	103,424	102,342	95,614	100,073	...	92,244	92,804	91,925	91,640	...	3½	341,402	− 30,747
Maidstone Corporation	894	458	435	441	...	788	426	509	400	...	3½	2,123	− 105
Manchester Corporation	50,803	37,851	37,523	40,607	...	43,149	36,212	37,804	36,955	...	4	154,120	− 4,596
Newcastle-on-Tyne Corporation ...	11,077	10,978	10,764	10,874	...	9,614	9,567	10,672	9,519	...	4	41,500	− 3,917
Nottingham Corporation	7,630	7,357	7,085	5,976	...	6,481	7,875	7,946	7,456	...	4	29,760	+ 1,710
Oldham Corporation	4,356	4,592	4,212	...	...	4,379	4,733	4,908	...	...	4	19,915	− 784
Preston Corporation	1,701	1,961	1,857	1,717	...	1,264	1,724	1,967	1,767	...	3½	6,721	− 515
Preston Motor 'Buses	...	...	...	...	...	92	128	145	123	...	3½	488	—
Reading Corporation	1,453	1,604	1,536	1,531	...	1,303	1,583	1,584	1,495	...	4	5,968	− 158
Reading Motor 'Buses	281	306	272	301	...	262	333	396	317	...	4	1,309	+ 151
Rotherham Corporation	2,640	2,164	2,093	2,093	...	2,121	2,076	2,349	2,182	...	3	6,607	+ 258
St. Helens Corporation	1,169	1,775	1,628	1,671	...	893	1,498	1,827	1,496	...	4	5,715	− 529
Salford Tramways	10,400	10,380	10,864	11,557	...	9,883	9,811	11,200	10,171	...	4¾	43,890	− 2,783
Sheffield Corporation...	19,180	18,805	19,656	18,083	...	17,360	17,799	18,836	18,090	...	4¾	77,172	− 4,743
Southampton Corporation	2,796	3,124	2,990	2,706	...	1,926	2,891	3,213	3,035	...	4	11,067	− 550
Southampton Motor 'Buses	80	88	87	168	...	71	102	100	103	...	4	377	− 46
Southend Corporation	1,720	1,864	1,723	1,592	...	1,413	1,967	3,065	2,148	...	4	8,595	+ 1,695
South Shields Corporation	...	1,394	1,362	1,449	...	...	1,726	1,715	1,655	...	4	7,117	+ 797
Sunderland Corporation	4,051	2,443	2,013	2,034	...	3,204	2,428	2,546	2,306	...	4	10,485	− 58
Swindon Corporation	417	365	346	374	...	335	338	398	343	...	3½	1,309	− 135
Tyneside Tramways and Tramroads	1,154	1,100	1,025	1,087	...	817	799	1,467	749	...	17	13,750	− 6,372
Wallasey Corporation	2,653	2,640	2,570	2,785	...	2,369	2,404	2,897	2,523	...	4½	10,609	− 955
Wallasey Motor 'Buses	160	223	164	239	...	214	192	284	196	...	4½	940	+ 57
Walsall Corporation	1,656	1,643	1,583	1,628	...	1,612	1,658	1,855	1,556	...	4	7,058	− 119
Walsall Motor 'Buses	951	870	823	839	...	888	920	1,170	817	...	4	4,042	+ 130
Walthamstow U.D. Council	2,013	2,020	1,747	2,114	...	1,771	1,976	1,896	1,769	...	4½	7,786	− 340
Warrington Corporation	1,034	1,047	1,008	1,041	...	975	1,025	993	981	...	4	3,974	− 156
West Ham Corporation	6,123	6,083	5,757	6,106	...	5,528	5,877	6,267	5,523	...	3½	22,409	− 1,660
Wolverhampton Corporation ...	1,993	2,187	2,120	2,218	...	1,657	2,232	2,603	2,189	...	4	8,682	+ 163
Wolverhampton Motor 'Buses ...	546	569	560	588	...	506	628	851	626	...	4	2,612	+ 349

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED April 9	April 16	April 23	April 30		1922. WEEKS ENDED April 8	April 15	April 22	April 29		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	239,225	236,503	220,423	240,293	...	215,020	218,060	225,339	229,211	...	17	3,629,718	− 278,703
London and Suburban Traction ...	54,007	53,568	48,596	55,342	...	46,873	50,634	52,264	50,223	...	17	796,542	− 70,219

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.		1921. WEEKS ENDED April 9	April 16	April 23	April 30		1922. WEEKS ENDED April 8	April 15	April 22	April 29		AGGREGATE. Wks.	1922.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		80,859	85,004	85,103	81,423	...	85,650	79,509	86,710	86,636	...	17	1,421,179	+ 53,598
Calcutta	Rs.	87,417	89,625	88,477	86,280	...	112,650	105,536	107,108	107,116	...	17	1,804,821	+ 645,547
Madras...	Rs.	(2 weeks)	49,568	(2 weeks)	49,668	...	(2 weeks)	56,445	(2 weeks)	48,502	...	17	396,179	+ 151,299
Pernambuco	..	3,953	3,989	3,974	3,594	...	3,498	3,440	3,044	3,281	...	17½	62,179	− 14,555

Companies Issuing Monthly Statements only.

		1920. Nov.	Dec.	1921. Jan.	Feb.	Mar.	April	1921. Nov.	Dec.	1922. Jan.	Feb.	Mar.	April	Wks.	AGGREGATE. 1921-22.	+ or −
		£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo		4,601	5,342	4,594	4,701	...	...	4,762	5,565	4,805	4,797	...	...	48	55,454	+ 3,216
Brazilian Trac. Mlrs		12199000	12600,000	12875000	11941000	13102000	...	14555000	15405000	15032000	14473000	15238000	...	13	44,743,000	+ 6,825,000
Brisbane		...	...	46.280	43,205	46,300	...	...	...	48.790	43,800	51,300	...	13	143,890	+ 8.105
British Columbia	$	858,842	917,668	908,385	838,682	867,083	...	877,335	940,113	907,242	821,828	849,680	...	39	7,771,665	+ 140,144
Buenos Ayres L'c'z		56,746	68.857	61,111	53,952	59,365	60.238	58.056	63,381	61,198	55,227	61,775	57,619	43	579,438	+ 8,486
Burma		53,696	50,481	50,035	48.405	50,931	...	58.271	54,194	59,362	52,380	60,296	...	34	463,423	+ 55,324
Cape Town ...		25.628	29,768	...	...	...	...	27,004	31,521	30.289	26,980	29,930	...	—	—	—
Carthagena & H. ...		2,714	5.560	3.877	2,839	2.226	2.329	1,717	3.237	3,075	2,773	2,145	2,991	17	10,984	− 287
Cordoba		19,122	19.299	18.696	18.600	21.717	...	22.698	22.641	22,152	21,918	25,382	...	52	277,368	+ 39.922
East India ...		4.234	4,271	4.299	3,819	4,168	...	3.945	4.058	4,080	3.737	4,446	...	34	33,017	− 410
Kalgoorlie... ...		2,969	3,140	2.418	*316	...	...	2,419	2,814	2.180	2.031	...	...	8	4,211	+ 1,747
La Plata		5,573	...	6,506	*728	*3,403	...	6.453	...	6.724	6,318	7,067	...	13	20,109	+ 9,471
Manila ...	$	320,345	315,599	321,449	306.389	298,317	...	306.850	316,467	309.252	310.001	284,576	...	13	903,829	− 22.255
Monte Video ...		43.846	...	50.863	48.119	48.925	46,189	47,426	...	32.634	48,111	51.158	47,960	26	279,419	− 7,458
Para		24.273	24,253	24.231	20,545	22,189	...	23,147	22.660	22.966	21.582	22,238	...	17	89,446	− 1,772
Port Elizabeth ...		6,620	8,185	...	...	...	...	6,828	8,344	8,120	6,690	7,851	...	—	—	—
Rangoon ...	Rs.	104,468	120,000	122.588	120,718	158.121	...	137,750	145,500	137.850	130.583	150,500	...	13	418,933	+ 17,536
Winnipeg ...	$	477,957	...	506,229	460,125	495,208	...	477,880	...	507,047	498,577	464,900	...	13	1,436,334	− 25,228

* Strike of Employees.

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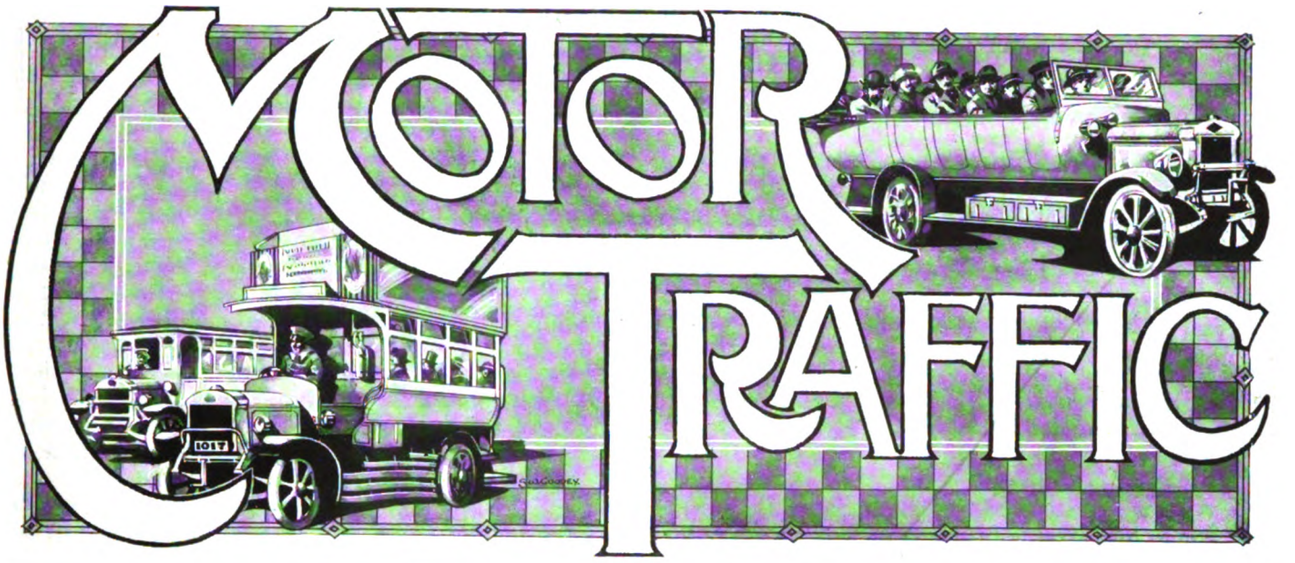

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

MOTOR OMNIBUS RECEIPTS.

The opinion of the writer of this note has been recently asked in connection with a controversy centring round estimates presented in respect of a projected motor omnibus service. These estimates were the work of a highly qualified and experienced omnibus-operating engineer, and so far as his estimation of probable costs was concerned, there was no serious difference of opinion. His estimated costs totalled approximately fifteen pence a mile, this being for a service of between twenty and thirty omnibuses in a town where traffic and road conditions are not exceptional. There must, of course, be more element of speculation in the estimates of probable receipts, which in this case was put at about twenty-one pence per mile for thirty-seated vehicles of the single-deck type. This figure was based on the assumption, generally to be regarded as a reasonable one, that fares should average not less than a penny a mile per passenger, and that on the average the vehicles would be carrying seven-tenths of their full complement. The reason that this figure was contested was that the tramways in the same town were found to show a very much lower return per vehicle mile, and the argument put forward was that it was not safe to anticipate a higher revenue for the omnibuses.

On analysis, one cause of the low figure per vehicle mile for the tramway was found to be that two or three vehicles were habitually run as a train. These were crammed full during the rush hours, but during the rest of the day the whole train only carried a few people. It was presumably found less expensive to keep the trailer vehicles attached than to go to the trouble of detaching and again attaching them as and when required. It is not reasonable to estimate such a low average for the omnibus as for tramcars used in this way. For one thing, the power-station of a tramway system must remain in operation even if only a few cars are running, and therefore there may be a smaller loss resulting for maintaining a service at idle hours than from withdrawing it wholly or partially. This does not apply to the omnibus. Further, the omnibus will operate primarily on routes where for one reason or another tramcars are not permitted. These routes are generally in central and residential areas, where the best paying traffic is likely to be obtainable. Even where the two systems run in direct competition, experience goes to show that people prefer the omnibus to the tramcar on account apparently of its superior flexibility, which allows it to be stopped wherever the passenger desires. Yet a further point is that a tramway system tends to clog itself during the rush hours, reducing its working capacity just when the maximum capacity is most needed. This is due to the fact that in the central area various routes converge and use the same lines, with the result that the cars on one service impede those on another service. This is also true to some extent of omnibus services, but in this respect the greater flexibility of railless vehicles is undoubtedly of advantage where traffic is at all dense. Altogether it is in the majority of cases unjust to the omnibus to estimate the limit of its earning powers by direct comparison with the tramcar from the standpoint of the average number of passengers carried as compared with the total number for whom accommodation is provided.

HEAVY PNEUMATIC TYRED VEHICLES.

It seems that the law of the future is destined to serve as a definite encouragement of the use of pneumatic tyres on commercial and public service vehicles of moderate size. Overseas there is a growing tendency to make the use of pneumatics on motor omnibuses compulsory, though tests carefully conducted in this country have not indicated any marked advantage of the pneumatic in respect of comfort or of road wear, except on vehicles travelling at speeds considerably in excess of those possible for omnibuses working mainly in heavy traffic. It may, of course, be said that the pneumatic has not yet had a fair chance, inasmuch as it has merely been applied to vehicles built for use with solid tyres, and the presumably better protection afforded by it has not been utilised for the purpose of lightening the chassis or reducing the engine power and possibly the fuel consumption. It will only be when we are able to make definite comparisons of vehicles designed for smaller loads, but specifically

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MOTOR TRAFFIC

intended to be fitted with pneumatics and solid tyres respectively, that the question of the merits of the former can be definitely determined. It seems quite possible that for heavy loads at moderate speeds it would be found that the advantages of the pneumatic are not sufficient to justify its use. On the other hand, a law permitting higher speeds to pneumatic-tyred vehicles has the effect of allowing them a greater working capacity, and so giving them an opportunity of a reduction in costs per mile run, despite the undoubtedly heavier item of tyre maintenance.

THE LOCK-OUT AND OTHER MATTERS.

The commercial motor vehicle manufacturing industry has since the war been peculiarly unfortunate. It has shared with the engineering industry as a whole the dislocation occasioned time and again by labour troubles. No sooner has it got upon a footing permitting of reasonably economical production than some strike or lock-out intervenes which, even if the workers in the industry are not themselves involved, is almost as fatal in its effects. Examples are to be found in the moulders' strike, the railway strike, and the stoppage of the coal mines, and now we have the engineering lock-out, which has had the effect of practically closing most of the factories. It can, perhaps, be argued that, even if works were now in a position to turn out their full output, the demand is lacking, and the result would merely be an accumulation of stock. In some cases and to some extent this is true, but even when we are passing through the deepest trade depression the manufacturer is handicapped if he cannot give deliveries at agreed dates or produce new machines to the special requirements of his clients. The competition of surplus Government vehicles has, of course, had a disastrous effect, particularly on business in vans and lorries of normal types. It is mainly in respect of public service vehicles and specialised municipal vehicles that the standard War Department chassis is not applicable, and the manufacturer has some real opportunity of doing business with new products. It is stated that the Government has not renewed its agreement with the purchasers of Slough, but by this time the harm has been done, and it is difficult to see what method of disposal of the remaining vehicles can be adopted that will not be more or less equivalent in its effect on the manufacturing industry.

HOW DRIVERS CAN SAVE FUEL.

Mr. Walter Jackson, an American electric railway and motor omnibus consultant, who has frequently visited this country to familiarise himself with progress in local transport here, has recently contributed an article to the *Commercial Vehicle* of New York describing the methods of the Birmingham and Midland Omnibus Company in securing fuel economy. It was during the later years of the war and immediately thereafter, when the price of petrol was nearly three times the figure of 1915, that the fuel economy campaign was inaugurated and carried to a successful issue. The services were divided into three classes, viz., "A," good, flat roads; "B," good, flat roads with medium hills, and city roads with frequent stops; and "C," very hilly districts and narrow roads. The men were put on a bonus and super-bonus plan, namely, so much a day and so much more per week if each day of the week had been within the stated figure. The average for the system as a whole was set at 6 miles per gallon, using the Imperial gallon, the engines of the 200 Tilling-Stevens petrol-electric omnibuses being rated 45 H.P. Investigation showed that the worst waste was due to engines being left running when a vehicle was standing, either for traffic stops or at the termini. This loss was found to average one pint for every five minutes' standing time. Second was the question of the engine speed after throttling down. It was suggested that the adjustment screw should be set so that the engine would just tick over, and should be so fine that the engine would not run in the garage when cold without a piece of paper or similar insert between the stop and the lever.

Other suggestions were as follow—To obtain the best running, co-operation must be used between the throttle and the shunt control lever. The shunt lever should be kept forward whenever possible, without the engine knocking or labouring, the throttle being kept so closed that only just sufficient fuel gets through to provide the power. Black smoke from the exhaust when running or when throttled down is a sure sign that the carburetter is set too rich. Hesitation in getting away or choking is another indication. Clinking badly on hills when very hot is a sign of too weak a mixture, or that the ignition is advanced too much. Under normal conditions on give and take routes with the throttle just open and the shunt lever tight forward, the engine should run sweetly with a gentle hiss from the carburetter. The petrol consumed on a given trip depends upon the speed the engine runs at, and the number of charges of petrol which are burned. It is therefore obvious that the slower the engine runs the less fuel will be used. On long down grades a considerable saving can be made by switching the engine off, the vehicles free-wheeling as much as possible. Power should be shut off at a considerable distance before the stopping place is reached so that all the fuel given to the engine to set it in motion can be absorbed. No petrol should be allowed to drop from the carburetter or pipes. In their own interest the drivers were cautioned to see that the tanks were full before going out, and they were also asked to note the amount put into the tank upon returning from a run. Strict instructions were given that the vehicles should not be overloaded, since it caused enormous wear and tear as well as excessive fuel consumption.

The effectiveness of the campaign may be judged from the fact that despite ageing equipment and a poorer grade of fuel, the miles per gallon for the year 1920 had risen to 6·3, compared with 5·6 in the year 1915. That this was combined with high mechanical efficiency appears from the fact that during the early summer of 1921 the omnibuses were operated about 40,000 miles per breakdown. The average daily run of an active omnibus was 100 miles, and including the reserve vehicles, etc., 75 miles. The total mileage for 1920 was about 4,500,000, and covered nearly 200 routes up to a round trip of 252 miles. The usual annual mileage per omnibus is 30,000 miles, although

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MOTOR TRAFFIC

some go up to 45,000 miles. During the summer months and on Saturdays and Sundays throughout the year practically every vehicle is out earning money in either regular schedule or in private work. A general detail examination and replacement of worn parts is conducted quarterly. Mr. Jackson concludes that American omnibus companies could save a great deal of fuel and cut down materially on their operating expenses by adopting some such system as that followed by the Birmingham and Midland Company. The scheme, too, is worth the attention of managers of undertakings in this country. Notwithstanding the lack of wisdom shown by some trade unions in discouraging the bonus system, employees can soon be brought to appreciate the addition of a substantial sum to their wages. Moreover, they should be shown that unless they put the highest degree of efficiency into their work they are failing in duty to their employers and to the expensive machines entrusted to their care.

GUY MOTOR COACHES.

A new service of motor coaches is being organised by Messrs. Keith and Boyle, Limited (the London representatives of Guy Motors, Limited, of Wolverhampton), which will be known as the "Orange Motor Coaches." The regular routes to be covered embrace all the principal resorts on the South Coast, as well as Margate and Clacton on the East Coast, while half-day trips to Windsor, Maidenhead, Dorking, Tunbridge Wells, Guildford, etc., will be a special feature of the service. In each case the Victoria Embankment near Charing Cross is to be the starting point.

Messrs. Keith and Boyle claim to have evolved the most luxurious type of motor coach yet offered for such services. Close study of the motor coach traffic has convinced them that for successful development the moderate size vehicle that ensures reliability and comfort is essential. In the Guy 25 H.P. chassis, which by reason of its silent running and efficient springing is so well suited for passenger work, reliability for continuous service can be depended upon, while by limiting the seating capacity to 22 passengers, scope has been given to the designer of the body to introduce many refinements which would be found impossible in the old type 30-seater with which we were so familiar during the previous season. Apart from the colour of the coaches, a rich orange, the most striking features in the body work are the ample space both in the seats and between them, the division of the seats on the half bucket principle and the general excellence of the fittings and appointments. From our illustration a general view of the seating arrangements will be seen. Each seat is eighteen inches wide, while the centre gangway adds greatly to the convenience of passengers. The seats are upholstered in real leather, hair stuffed on spring frames, the floor being well carpeted. There are double entrances on the near side with single entrance on off side for the driver. These, as well as the steps, are of the omnibus type, thus rendering the body easy of access, the doors being mounted with three cranked hinges.

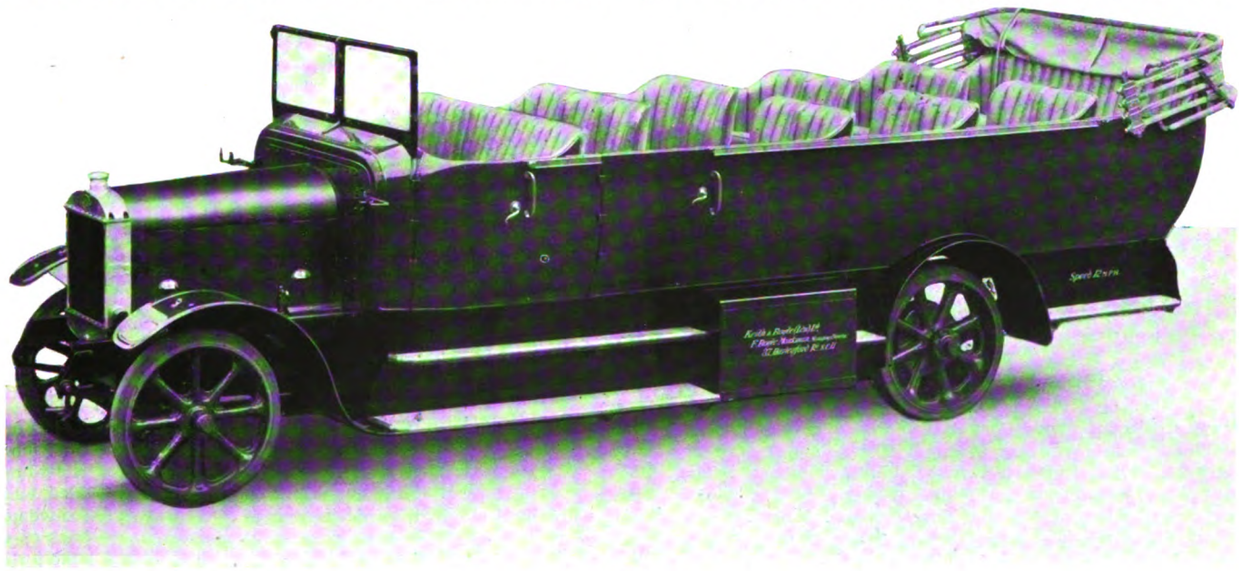
The hood is the special design of the body builders, Messrs. Harrington, Limited, of Brighton, and is of the sliding type mounted on roller bearings. Continuous channels are provided along which the hoop sticks slide to their respective positions, where they are locked. It is claimed that this hood can be set up or taken down within two minutes. It is so mounted and fitted that although there is very little overhang when down, it is housed well clear of the passengers occupying the rear seats.

The Guy 25 H.P. chassis, as will be seen from the following brief specification, has a number of special features. It is fitted with a four cylinder engine with bore and stroke of 4 in. and 5½ in. respectively. The valves are of the mushroom type, placed in the cylinder head, this being detachable and water cooled. The design of the cylinder head and valve arrangement is patented and has the distinct advantage of being easily removable without interfering with the waterpipes, tappets, exhaust, or inlet pipes. Another advantage of the detachable head is that in conjunction with the large inspection doors which are provided in the crank case the connecting rod big end bearings can be adjusted or removed and the piston and connecting rod entirely drawn out through the top of the cylinder without dismantling the engine. The high tension magneto is placed high up, and is readily accessible. A "Zenith" carburetter is fitted with gravity feed.

The gear box provides for four forward speeds, and is arranged for thin oil lubrication. The change speed gate and lever is attached directly to the gear box, thus obviating the risk of jamming through want of alignment.

The engine and gear box complete with all operating gear is carried on a sub-frame which is suspended from the main frame by three universal joints. This arrangement prevents the distortions of the main frame being transmitted to these vital parts. In practice it has been found that even with one wheel raised two feet the sub-frame remains in true alignment.

The back axle is of the double reduction bevel and spur wheel type, the bearings supporting the gears being on the ball and roller system. The weight of the vehicle is taken by the axle case and wheel tubes; any distortion therefore is not transmitted to the axle shafts, which only take the drive. Special attention has been paid to the design



A Guy Motor Coach.

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MOTOR TRAFFIC

of the brakes. The foot brake operates on the bevel pinion shaft on the back axle, so that none of the strain goes through the universal joints. A compression spring arrangement is provided in the brake operation gear, so that only a desired maximum pressure can be put on the brake. Both brakes have each half of the shoe compensated by a sliding cam to ensure equal application all round.

The springs are designed with a special clip, which registers with the spring pads on the axles instead of the usual practice of drilling and fitting with a dowel peg. The rear springs are underslung, which not only permits of a lower loading line, but gives better springing to the vehicle and longer life to the tyres.

Dunlop solid tyres are fitted (single on the front wheels and twin on the rear) and these give all the comfort desired, so satisfactory has the springing of the chassis been found in practice.

MIDGLEY-SCHOLEY LIGHTING AND STARTING.

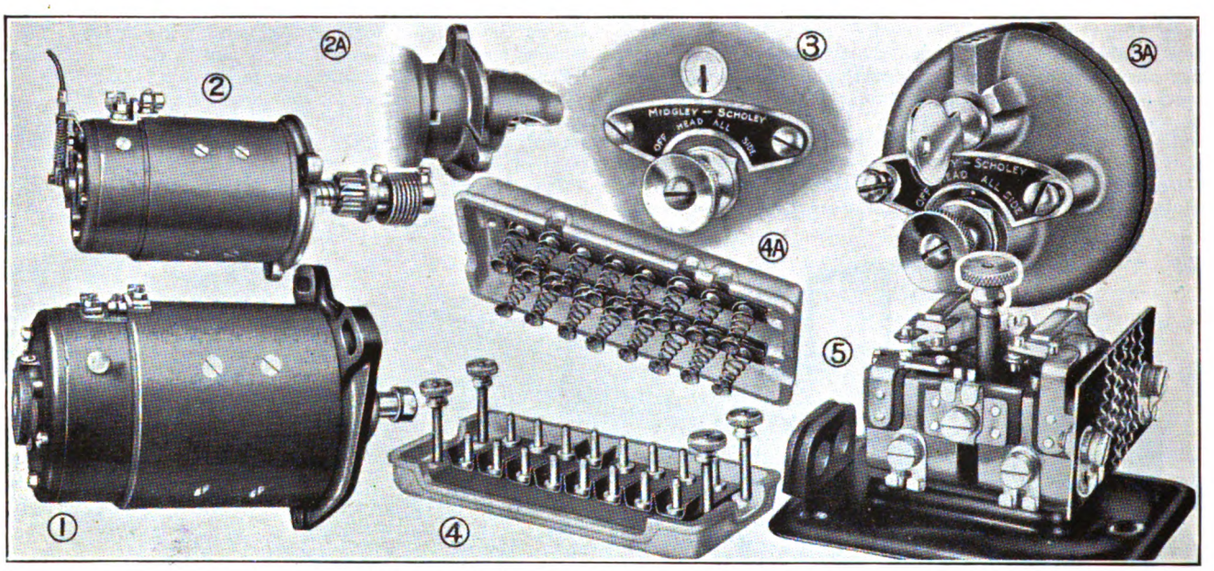
A System Possessing New Features of Proved Utility.

That improvements on existing methods of electrical lighting and starting of automobiles were needed has been evident during the past few years. Notable advances are comprised in the Midgley-Scholey system in which, it is claimed, many fundamental faults are eliminated. Designed by Mr. A. H. Midgley, the apparatus shows a marked advance on existing lighting and starting equipments. The inventor was a pioneer in designing equipments of this description, and has become the foremost authority on the subject. Under these circumstances it is not surprising to learn that Messrs. Scholey and Company, Limited, have undertaken the manufacture of the apparatus at their Croydon Works, where they have had wide experience in small motors and dynamos. The originality of Mr. Midgley's inventions is attested by the fact that among the features of the Midgley-Scholey system covered by patent applications in all the principal manufacturing countries are the following—The method of regulation of the dynamo; the automatic control of dynamo output to prevent overcharging of the battery; operation of the starter by means of a Bowden wire or other device from the switchboard; combination of the switchboard for controlling and locking the starting, lighting, and ignition circuits; construction of the junction box, having spring-held connections; construction of pole pieces and other parts of the dynamo and starter in order to simplify manufacture.

Full details of the features of the system are set forth in a brochure, which can be obtained on application to Messrs. Scholey, of 56 Victoria Street, S.W.1. From that publication it will be seen that vital improvements have been effected in the dynamo, and that the form of controller and cut-out used in conjunction with it has an important bearing on battery upkeep. The starter, switchboard and junction box, while showing great originality in design, achieve success because they mark a definite stage in the practical application of lighting and starting.

Midgley-Scholey dynamos are made in four sizes, ranging from 3½ ins. to 5 ins. diameter of yoke, and are suitable for saddle or flange mounting, with or without ignition. The design gives good regulation over a wide range of speed. Battery charging is by the constant current system, the only method suitable for charging under all conditions, as the dynamo voltage follows the battery voltage, and in the case of sulphation it will rise until it is sufficiently high to break it down and charge the battery. With existing constant current systems there is danger of overcharging, with consequent loss of acid and damage to the battery. Instructions are often given to switch off the dynamo when the voltmeter shows 15 to 16 volts. This is not always done, especially in the case of commercial vehicles, and on the majority of equipments now supplied no voltmeter is provided, so that one does not know the condition of the battery until it fails.

The drawbacks are overcome by the Midgley-Scholey apparatus, which is provided with a very neat form of controller incorporated with the automatic cut-out. The controller does not remain out of action until the battery is discharged, but each time the speed of the dynamo falls below its minimum generating speed (which is usually about 7 miles per hour), it is then accelerated and the full output is given for a few seconds until the battery voltage rises, when the output is reduced. The automatic-cut out disconnects the dynamo from the battery upon the speed falling below the minimum generating speed, and thereby prevents the battery discharging through the dynamo. When the speed rises sufficiently to charge the battery, the cut-out connects the dynamo to the battery. It is claimed that the Midgley-Scholey system is the only one which properly takes care of the battery under all conditions.



Midgley-Scholey Lighting and Starting System.

1—Dynamo; 2—Starter; 3 and 3a—Switchboard; 4 and 4a—Junction Box, with spiral springs holding cables firmly; 5—Automatic Controller combined with cutter, providing against overcharging batteries.

The Midgley-Scholey switchboard eliminates the complication of several switches. A neat aluminium junction box is provided, which is usually fitted to the side member of the chassis in a convenient position, instead of in the inconvenient position at the back of the instrument board. The wiring and connections are the same for the small car and the large car, provision being made in the junction box for additions such as horn, dash lamp, interior lighting, dimmer or ammeter, so that, no matter whether it is originally installed on an 8 H.P. chassis or on a 40 H.P. chassis, the system is complete, yet allows for additional fittings without the necessity of installing special junction boxes. These features are unique.

As only one system of wiring and connections is employed between the various units, the whole of the wiring up to the junction box can be made a permanent feature of the chassis. In the case where it is necessary to remove the switchboard for the fitting of a body, all that requires to be done is to take off the cover of the junction box and lift the switchboard cable off its respective studs, and disconnect the Bowden wire from the starter.

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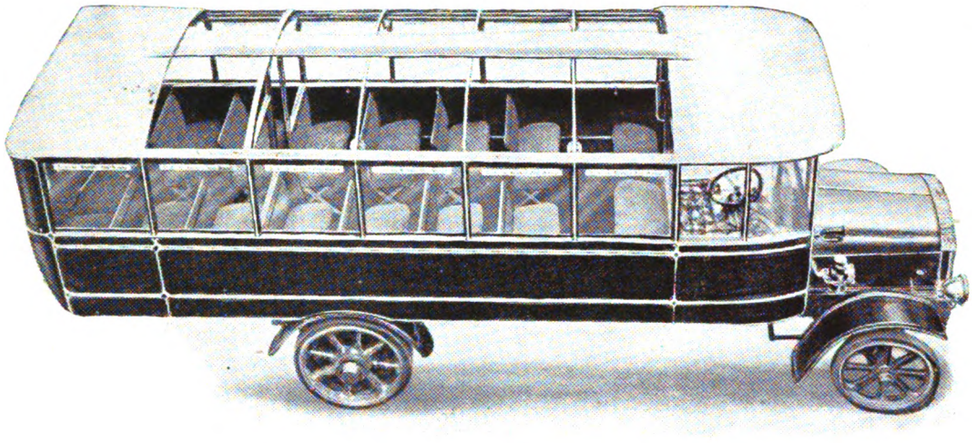
MOTOR TRAFFIC

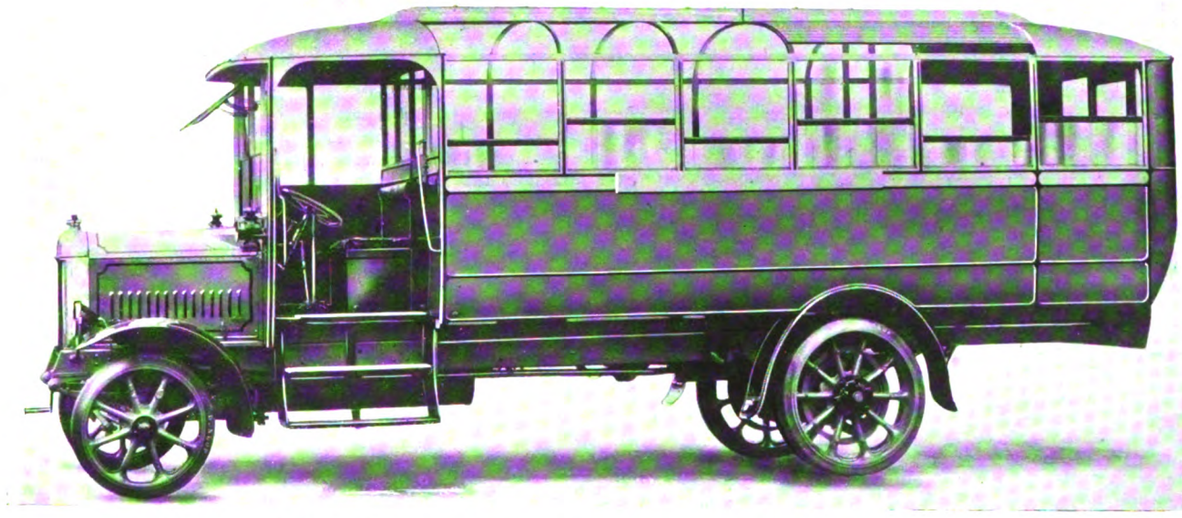
AN ALL-WEATHER MOTOR COACH.

At the invitation of Messrs. Strachan and Brown, of Holland Gate, High Street, Kensington, our representative recently had an opportunity of inspecting the new roll roof which in conjunction with an improved type of balanced drop windows enables a closed omnibus to be quickly converted into an open coach and *vice-versa*. The great advantage of this system is the fact that the change can be effected in a few moments and without stopping the vehicle, so that should the coach be running as an open vehicle and be suddenly overtaken by a rain storm, the passengers themselves can immediately draw the roof blinds and pull up the windows, and so convert it into a closed omnibus. The principle upon which the roof sections are operated is that made familiar by the roll-top desk. Flexible wooden blinds of small section slats are mounted upon a stout waterproof cloth which is attached to a spring roller. These rollers are housed in a shallow box which runs longitudinally down the centre of the roof, the covers being mounted in pairs. The hoop sticks carrying the covers are of a special section, and are so constructed that they not only serve as guides for the rolling cover, but effectually prevent the admission of water to the interior. The width of the face of these sticks is sufficient to give ample bearing surface for the cover on each side, a groove to take any water that may find its way in from the edge of the roller, and a raised portion in the centre to which is attached a metal strip which completes the slot in which the rolling cover runs. Although the hoopsticks are less than one inch in thickness, owing to the method of reinforcement employed they are of ample strength. To close the roof each section of the cover is drawn from its housing and fastened to the cant rail by means of a special clip fastening which ensures a tight fit, thus eliminating the possibility of rattle or the admission of water. A shallow gutter runs the length of the vehicle along the cant rail, and from this the water is led to the ground. The whole of the roof device, for which patents are pending, is extremely neat, and when operated by our representative worked with remarkable ease. The tension on the spring is sufficient to retain each section of the cover in its housing without any kind of fastening, so that it is always free to be drawn when required. The inside of the cover shows the slats polished in their natural colour, and gives a most pleasing effect; the exterior is painted white to conform with the fixed portion of the roof over the driver's seat and the rear of the vehicle. The cover of the longitudinal box or housing is so shaped that while it affords sufficient space for the free working of the rollers, it is hardly noticeable when the roof is closed. A noteworthy point in this form of roof is the ample ventilation which it provides even when the doors and windows are all closed.



Strachan and Brown's All-weather Coach with Canopy Top Open.

As will be seen from our illustrations, in one of which all the sections are shown open, the roof is arranged in three double sections, two covering the main compartment of the vehicle and one the rear, or smoking compartment. As the working of each section is entirely independent of its fellows, it will be seen that while the main compartment may be required to be covered, the smoking compartment can be open at the will of the passengers.



Side View of Coach, showing Canopy Top and Windows Partly Closed and Partly Open.

The improved type of silent and balanced drop windows with which the vehicle shown is fitted completes the Strachan and Brown scheme of the all-the-year-round coach. In this the retaining mechanism has been considerably improved by the use of a new type of gearing. It is claimed for this that any window so fitted

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is rattle-proof, and can be adjusted at any height ; further, that vibration merely tends to tighten the window.

An important point in connection with both the roller roof and the improved type of window is that they can be fitted to any existing vehicle. The vehicle shown in the illustration can be taken as a fair example of the excellent body work for which Messrs. Strachan and Brown are noted. It is arranged to seat 33 passengers, and is partitioned to form a smoking compartment at the rear, to which there is an emergency door. Extra seating accommodation can, however, be obtained by the fitting of a new type gangway seat, which is supplied with a comfortable spring cushion and back-rest strap. This has recently been introduced by Messrs. Strachan and Brown, and is so mounted that it swings under one of the adjacent seats when not in use, where it is firmly held in position clear of obstruction.

L.G.O.C. COACH TOURS.

Mr. G. J. Shave and the Pneumatic Tyre.

A programme even more varied and extensive than those of previous years has been prepared by the London General Omnibus Company for this season's motor coach tours in the Home Counties. During the last couple of years these tours, organised as they are on excellent lines and conducted with the most up-to-date and comfortable vehicles, have become a distinct feature of the round of amusements provided for the choice of Londoners and visitors to the city. Each week in the coming season there will be 40 different trips, long and short, from which the holidaymaker may select, according to his taste and purse. In the first place there are eight conducted whole-day tours of from 70 to 90 miles in length. Each will start from St. James's Park Station at about 10 a.m., and the party will arrive back in town in time for dinner and the theatre. These day tours comprise runs to Guildford and Hindhead, Maidstone and Rochester, Windsor and Burnham Beeches, Tunbridge Wells and Farningham, Guildford and Virginia Water, Penshurst and Godstone, Maidenhead, Windsor and Hampton Court. The last-named, "The River Tour," includes a trip by launch from Boulter's Lock to Windsor. Experienced guides accompany these tours, and indicate places of particular interest. It is noteworthy that for an inclusive booking fee of one guinea, table d'hote luncheon and tea at first-class hotels are provided *en route*.

There are also 19 half-day tours of from 50 to 60 miles in the country, starting at 2 p.m. Some of these run from central London and others from various suburban centres. A halt is made for tea and a ramble round some place of especial interest. Other features of the General Omnibus Company's summer programme include three-hour evening tours, and "Seeing London" excursions.

For the convenience of patrons a number of suburban booking offices have been established.

On Saturday, May 6, a party of London pressmen were invited to make an inaugural trip on the Tunbridge Wells and Farningham route. The weather was ideal, and the outing proved in every way thoroughly enjoyable and successful. A new type of coach was used, with comfortable "armchair" seats, and with a folding hood which rests above the dashboard, instead of at the rear, when not in commission. The vehicle, which ran with marked smoothness, had but one entrance door, and the seating was so arranged that the occupants could move freely from front to rear. During luncheon at the Spa Hotel, Tunbridge Wells, Mr. G. J. Shave, chief engineer and operating manager of the company, in welcoming the guests, mentioned that when these tours were started in 1920, the programme comprised 20 trips weekly, whereas for the present season 62 per week were being arranged. Four new 20-seater coaches *de luxe* were nearly completed, with pneumatic tyres. With regard to this class of tyre, the company were proceeding with experiments very carefully. Some giant pneumatics had served extremely well, giving a mileage of 12,000 on a complete set. The pneumatic tyre was, however, not yet ready for adoption on heavy public service vehicles, and more use was likely to be made of the cushion tyre, with which, he was sorry to say, British manufacturers did not seem anxious to get busy.

The return journey was made through many of the Kentish hop fields and a delightful countryside, tea being served at Farningham. Mr. S. J. Webb (chief passenger agent), Mr. J. H. Richardson (press agent) and his assistant, Mr. B. C. Foxcroft, accompanied the party.

Messrs. Leo Swain and Company, Limited, 237 Deansgate, Manchester, are placing agencies for the Luchard air compressor plants, and anyone desirous of taking up this agency should communicate with them.

RULE OF THE FOOTPATH.

Progress of the Proposal to Keep to the Left.

The London Safety First Council on April 7 decided to ask the municipal authorities in Greater London to take concerted action to bring into force on July 1 next a change in the rule of the footpath, whereby pedestrians would be required to walk on the left instead of on the right of the footpath.

The chairman (Sir Edward Smith, London County Council) said they had every hope that this action, necessary to abolish the dangerous method of walking on the pavement edge in the same direction as the road traffic, would be actually taken, for the Safety First Council's campaign had so far succeeded that the Ministry of Transport had given it their blessing, and the general body of municipal authorities were in favour of the change. He regretted, however, that the City of London authorities were opposed to it. There was no place in the world, he thought, where the reversing of the rule would be of greater benefit.

Mr. H. E. Blain, hon. secretary, reported that the Commissioner of Metropolitan Police had intimated it was not the intention of the metropolitan police to oppose the change. With the exception of the City of London police the authorities generally were, he claimed, in favour of it. Many provincial cities had now definitely adopted the rule of the left.

The Director General of Roads has asked local authorities throughout the country to consider the adoption of a "keep to the left" rule for pedestrians.

After hearing a deputation from the Tramways Committee, the Glasgow Magistrates Committee have adopted the new rule, and have directed that the attention of the public be drawn to it by the affixing of notices on lamp-posts and in the tramway cars. Megaphones are also in use on some of the cars to call upon pedestrians to "keep to the left."

Birmingham Watch Committee on April 5 considered a letter from the Tramways Committee in favour of altering the rule of the footpath. The chief constable reported that the newly-formed Safety First Council were taking steps to educate the public, and were approaching the Education Committee on the matter.

LONDON OMNIBUS EFFICIENCY.

Address by the Operating Manager.

A great deal of interesting information concerning the mechanical efficiency of the vehicles of the London General Omnibus Company was given by Mr. G. J. Shave, the operating manager and chief engineer, in an address on April 14 to the City of London Tradesmen's Club. Mr. Shave dealt at length with the operations of the new overhaul works at Chiswick, an illustrated description of which has appeared in these pages.

Enterprise, under conditions none too favourable, he said, had erected the Chiswick works, but efficiency hitherto unattainable would be the result. In 1921, before the opening of the works, a high standard had been reached. In that year the lost mileage due to breakdowns was only three miles in 10,000. An especially valuable department was that devoted to experiments and research. Special engine tests were made, and the relative value of carburetters, magnetos, and lubricants were ascertained. Attention was also paid to finding new fuels and fuel-saving devices.

Replying to questions, Mr. Shave stated that it was impossible to widen the cross seats of the new vehicles, as the width of the omnibus was restricted to 7 ft. 2 in. by the licensing regulations, although any other vehicle not a public vehicle could have a width of 7 ft. 6 in. The company had not yet succeeded in obtaining an amendment of the regulation. In order to lessen vibration they were experimenting with a cushion tyre. Roof coverings had also been tried. The open top was best for seeing London, and taking an average of three years before last year's abnormal dry season it was found that there was rain during only 4 per cent. of the hours of running.

"T.B.R." Guide.—The issue of this popular guide for May 1922 (Messrs. Rieu, Wiley and Company, 123 Pall Mall, S.W.1), contains particulars of a number of additional services. The compilation is extremely useful, and we are surprised that tramway managers do not more generally arrange for the inclusion in it of their services in greater detail. The number for May contains also a list of motor coach services arranged alphabetically under the starting point. Each service is given a separate paragraph, starting with the name of the firm supplying the service and the chief address for booking.

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REGULATION OF ROAD VEHICLES.

REPORT OF THE DEPARTMENTAL COMMITTEE.

The second interim report of the Departmental Committee on the Taxation and Regulation of Road Vehicles was issued on April 13 by the Ministry of Transport. Taxation and revenue were dealt with in the first interim report, which was issued on March 31, 1920. The committee was constituted as follows—Sir Henry Maybury, Director-General of Roads, Ministry of Transport (chairman); Sir George Beharrel, Director-General of Finance and Statistics, Ministry of Transport; Sir Thomas Berridge, Royal Automobile Club; Sir Harcourt E. Clare, Local Authorities; Mr. Stenson Cooke, Automobile Association and Motor Union; Mr. F. L. D. Elliott, Police Authorities; Mr. W. Rees Jeffreys, Society of Motor Manufacturers and Traders; Sir Philip Nash, Director-General of Traffic, Ministry of Transport; Mr. W. H. Pascoe, Board of Customs and Excise; Mr. F. Pick, London and Provincial Omnibus Owners' Association; Mr. E. S. Shrapnell-Smith, Commercial Motor Users' Association; Mr. C. W. Tindall, Agriculture; and Mr. E. Twentyman, Treasury.

The report extends to 77 pages. Forty-four witnesses were heard. They were representative of the motor organisations and manufacturers, tyre manufacturers, steam wagon makers, County and Urban Rural Councils, London and Provincial Omnibus Owners' Association, London General Omnibus Company, Metropolitan, North Riding, Kent, Lincolnshire, and Manchester Police, National Transport Workers' Federation, County Surveyors' Society, etc.

CLASSIFICATION, CONSTRUCTION, ETC.

The Committee state that their object has been to provide for the utmost possible freedom for progress in the construction and use of motor vehicles consistent with the public safety and the wear and tear of the roads. They suggest that the time has arrived for a more convenient classification of mechanically-propelled vehicles, and they put forward a system of classification consisting of the following groups—(1) Locomotives—(*a*) heavy, (*b*) light; (2) heavy motor cars, including tractors; (3) agricultural tractors; (4) motor cars; (5) motor cycles; (6) exceptional vehicles. The Committee deal with construction, design, weight, etc., with an additional section on trailers, and make recommendations as regards testing of axle weights, efficiency and police examination of brakes, ploughing engines, and road rollers. A general recommendation is that the Minister of Transport should have wide powers to vary the regulations in the light of future experience and progress in construction, that he should be empowered to authorise the use for experimental purposes of special vehicles which do not comply with the general recommendations, and that he should have power to make regulations for special classes of vehicles.

NO FIXED SPEED LIMIT FOR CARS.

With regard to the suggestion that a higher limit should be imposed, the Committee report that "no reasonable fixed limit can be a suitable speed for motor cars on all roads and under all conditions, and it would be impossible to define the roads upon which any fixed maximum speed should be permitted. The Committee have come to the conclusion that the maximum speed limit should be abolished, and that the public would be more effectively protected, and less irritation caused to the motorist, by the rigid enforcement of the regulations as to dangerous driving.

In regard to dangerous driving, they suggest that the present statutory provisions should be made applicable to all mechanically-propelled vehicles and the penalties increased. The penalties suggested are as follow—

First Offence.—Fine not exceeding £50, with power to the Court to suspend the driver's licence and/or disqualify him from holding one for such period as they may think fit.

Second or Subsequent Offence.—Compulsory suspension of licence and disqualification from holding one for such period as the Court may think fit, unless for reasons to be stated the Court shall specifically determine otherwise, together with a fine not exceeding £100, and/or imprisonment for a period not exceeding six months.

SPEEDS FOR HEAVY VEHICLES.

In the case of heavy motor cars, locomotives, etc., the Committee consider it essential that there should be some restriction of speed in view of the fact that the speed of such vehicles is a serious factor in relation to road damage, and damage to property by vibration. The speeds suggested are set out in the following table—

I.—HEAVY MOTOR CAR FITTED WITH PNEUMATIC TYRES.

Reg. Unladen Weight.	*Max. Axle Weight on any One Axle.*	*Max. Speed.*
Not ex. 3 tons 15 cwt.	Not exceeding 4 tons.	20 miles per hour.

II.—HEAVY MOTOR CAR FITTED WITH TYRES OF A SOFT OR ELASTIC MATERIAL, INCLUDING PNEUMATIC.

Reg. Unladen Weight.	*Max. Axle Weight on any One Axle.*	*Max. Speed.*
Not ex. 5½ tons ...	6½ tons	16 miles per hour.
Ex. 5½ tons but not ex. 7¼ tons ...	8 tons	12 miles per hour.
	10 tons	8 miles per hour.

III.—HEAVY MOTOR CAR WITH TRAILER, BOTH FITTED WITH PNEUMATIC TYRES.

Unladen Weight of Trailer.	*Maximum Speed.*
Not exceeding 40 cwt.	* 16 miles per hour
Exceeding 40 cwt.	* 8 miles per hour.

IV.—HEAVY MOTOR CAR FITTED WITH PNEUMATIC TYRES OR TYRES OF A SOFT OR ELASTIC MATERIAL, WITH TRAILER FITTED WITH TYRES OF A SOFT OR ELASTIC MATERIAL OTHER THAN PNEUMATIC.

Unladen Weight of Trailer.	*Maximum Speed.*
Not exceeding 40 cwt.	* 12 miles per hour.
Exceeding 40 cwt.	* 8 miles per hour.

V.—HEAVY MOTOR CAR FITTED WITH NON-ELASTIC TYRES, WITH OR WITHOUT TRAILERS, OR ANY HEAVY MOTOR CAR DRAWING A TRAILER FITTED WITH NON-ELASTIC TYRES.

Maximum speed, 5 miles per hour.

As regards reduced speed limits in populous areas, "they consider that the duty of suitably varying from time to time the speed at which a vehicle is proceeding so that it may do so with safety, must of necessity rest with the driver, who must assume full responsibility for driving in such a manner as will not endanger any other vehicle or person upon the highway." They suggest that the case would be met by the institution of standard forms of cautionary signs to be prescribed by the Minister.

DRIVERS' FITNESS AND KNOWLEDGE. RULES OF THE ROAD.

The Committee express the opinion that "the institution of tests of mechanical knowledge or of physical fitness before the issue of motor drivers' licences is not justified owing to the practical difficulties, quite apart from the very heavy expenditure which any such proposals would involve." They recommend, however, that every applicant for a driving licence should be required to make a declaration on the form of application that to the best of his knowledge he is not suffering from any disease or physical disability which would be likely to cause the driving of a mechanically-propelled road vehicle by him to be a source of danger to the public. They do not recommend any alteration of the minimum age limit.

The essential signals indicating the intention to stop and the intention to turn to the right, in the opinion of the Committee, should be made compulsory. The signals recommended by the Advisory Committee on London Traffic for slowing down, turning to the left, and inviting to overtake should be encouraged in every way. As regards rules of the road, the Committee think it would be unwise to lay down a series of regulations enforceable by penalties, but suggest that the existing law should be modernised, and that a statement of the rules and courtesies of the road should be printed on every driving licence.

On the subject of the left-hand drive, they consider that there is no evidence which would justify the prohibition or restriction of the use of such cars, though they consider it essential that the driver should be able to give the proper traffic signals.

MIRRORS, LIFE-GUARDS AND SPLASH-GUARDS.

Other recommendations deal with the above-mentioned subjects in the following terms—

Where a vehicle is so constructed or used as to prevent the driver from observing or hearing readily vehicles overtaking him, it should be provided with a suitable reflecting mirror or sound receiver and transmitter, unless there is a man travelling on the rear of the vehicle or of any trailer or trailers drawn thereby with a suitable means of communicating with the driver.

All vehicles which are now, or at any time shall be, permitted to travel at speeds of 12 miles per hour and over, and which are not fitted with running boards or the equivalent, should be constructed or fitted with guard rails in such a manner as effectively to guard

* In no event shall the speed be greater than the legal maximum for the heavy motor car if used without a trailer.

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the space between the front and rear wheels. The question of the provision of guards in front of vehicles should be reconsidered as soon as satisfactory devices appear to be available.

All developments in the invention of mud splash-guards should be watched carefully with a view to the reconsideration of the question of their compulsory use when satisfactory appliances have been devised.

EXPERIMENTS, GAS AND EXTRAORDINARY TRAFFIC.

In order to secure reliable data as to the actual effect on roads of the different types of vehicles travelling at various speeds, the Minister of Transport, the Committee advise, should be empowered to construct road lengths and build or subsidise vehicles for experimental purposes, and to arrange trials of vehicles which do not comply with the regulations.

It is suggested that the Minister of Transport should be empowered to make regulations requiring the use of efficient spark arresters, and that the use of compressed gas as a means of traction should be allowed only under a special licence.

With regard to extraordinary traffic it is recommended that an agreement should be made between the parties for strengthening a road to carry the extra traffic before it begins.

PROSECUTIONS AND PENALTIES.

In view of the recommendations that the speed limit should be abolished, the Committee regard it as essential that the rear identification plate should be clearly and legibly illuminated at night. It is suggested that the Minister should be empowered to inquire into accidents where either the nature of the road or defect in the vehicle is alleged as a cause, and where accidents result in serious injury or loss of life.

The following recommendations are made on the question of prosecutions—(1) In all speed limit prosecutions two witnesses shall be necessary for conviction. (2) Notice of intention to prosecute should be given with the least possible delay. (3) It should be the duty of owners to assist in tracing drivers who have committed offences. (4) If the speed limit is abolished, the penalties for dangerous driving should be increased. In the case of persons who apply for licences or drive cars while their licence is suspended, the Committee recommend that the maximum penalty, even upon a first offence, should be imprisonment for a period not exceeding twelve months without the option of a fine, and that the court should be given discretion as to the imposition of hard labour.

The Committee recommend that the existing law in respect of mechanically-propelled vehicles should be simplified and consolidated, that English and Scottish locomotive law should be unified, and that as far as possible local by-laws and regulations which are a departure from the general law should be discouraged.

MOTOR TAXATION RETURNS.

A return issued by the Ministry of Transport shows that the total receipts from motor taxation from December 1 last to February 28 was £7,756,654. During this period the aggregate total number of licences issued was 669,530, of which 574,490 were annual and 95,040 were quarterly. The following is an analysis of the principal returns—

	No. of Licences.	Tax Receipts.
Cars taxed on horse-power	214,529	£3,406,032
Motor-cycles	217,427	553,927
Commercial vehicles	131,866	2,440,290
Road locomotives, etc.	1,501	34,074
Motor tractors, etc.	1,096	14,543
Motor hackneys	60,382	1,034,885
Tramcars	13,259	9,943
General identification marks	7,968	58,546
Horse-drawn (private and hackney)	176,039	137,707
Miscellaneous receipts	—	63,660

TILLING-STEVENS MOTORS, LTD.

The directors of Tilling-Stevens Motors, Limited, in their report for the year ended December 31 last, state that the result of the year's working is a loss of £148,212, to which must be added the debit balance brought in of £18,170, leaving to the debit of profit and loss account £166,382. The Board regret the loss, but they remind the shareholders of the abnormal trade conditions which prevailed throughout the whole of the year. In addition, the stocks in hand at December 31, 1921, taken at market prices, were considerably lower than the actual costs.

MOTOR VEHICLES FOR MUNICIPALITIES.

WORTHING ELECTRICITY COMMITTEE have in view the purchase of an electric vehicle.

SYDNEY (N.S.W.) COUNCIL propose to purchase a pneumatic pressure street flusher.

BATH CITY COUNCIL have decided to purchase a 1-ton truck for the electricity department.

BURNLEY HEALTH COMMITTEE have invited tenders for the supply of a new chassis for the ambulance.

AUDENSHAW URBAN COUNCIL have purchased a tipping wagon for the collection of house refuse.

WARRINGTON CORPORATION are arranging to provide the Medical Officer of Health with a four-seater motor car.

BOLTON CORPORATION have authorised the purchase of a car, with all-weather body, for the waterworks department.

HULL FINANCE COMMITTEE have sanctioned a proposal of the Watch Committee to purchase a new motor fire engine.

RIPON CITY COUNCIL are considering the question of purchasing a motor tipping wagon for the general use of the highways and sanitary departments.

BOURNEMOUTH HIGHWAYS COMMITTEE suggest an allowance of £150 per annum to the Borough Engineer for the provision and upkeep of a motor car.

MARYLEBONE HIGHWAYS COMMITTEE recommend the purchase from Straker-Squire, Limited, of a new chassis for £850, and a reconditioned chassis for £370.

BLACKPOOL HEALTH COMMITTEE have asked their chairman and the medical officer to report on a proposal to purchase four motor conveyances for the health department.

KENDAL CORPORATION, who for some time have been considering the question of motor traction, have asked a deputation to visit localities where refuse is removed by motor transport and to inspect the types of vehicles in use.

CALCUTTA MUNICIPAL COUNCIL, who had decided to purchase two motor fire engines, have now arranged to postpone the purchase of one "until the Act is amended." The Council have also reduced the provision of 15,000 rupees for the purchase of a 2-ton lorry to 10,000 rupees.

BIRMINGHAM CORPORATION are considering the provision for their veterinary department of a light motor car at a cost not exceeding £300. They believe that this would be more economical and speedier than the present arrangement by which two cabs and a four-wheeled trap are used.

GLASGOW WATCH COMMITTEE have had a letter from John Morris and Sons, Manchester, notifying that the firm have an improved type of turntable fire escape under construction, and inviting the committee to see it. The committee have asked a sub-committee to inspect the new machine, and also the escapes offered by two firms in London.

TRAFFIC ON LANCASHIRE ROADS.

The County Surveyor of Lancashire has drawn attention to the fact that, in spite of trade depression, there has been a considerable increase in mechanically-propelled vehicles using the main roads during the past year, and this would probably be further increased when trade again becomes normal. Further, it seemed to be the generally accepted opinion that the Ministry of Transport would shortly recommend a substantial increase of the present legal weights and speeds, both for commercial vehicles and motor omnibuses, which would add materially to the cost of road maintenance.

Several new omnibus services had been started during the year, and these were being added to almost every month. In consequence, greater lengths of main roads were in urgent need of immediate re-surfacing with some class of material other than ordinary macadam. The greater portion of the Liverpool and Manchester Road had been surfaced with tar macadam during the past ten years, but the increase in the number of heavy mechanically-propelled commercial vehicles using this road has been so extraordinary during the past three years that the surveyor is of opinion a still more expensive form of surfacing is required.

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OMNIBUS SERVICES.

BRISTOL.—At the annual meeting of the Bristol Tramways and Carriage Company, Limited, Mr. Samuel White (chairman) stated that the company had reconstituted their fleet of omnibuses running from Bristol into the country. They went 70 miles away from Bristol, and the routes totalled something like 700 miles. That meant that they were looking after the western district. They regarded themselves as the people to work those services with public vehicles on the main roads in the whole of that territory. Their policy was not to go further at present, but in regard to whatever services were called for in that area—fresh routes or additional vehicles—they regarded themselves as the firm to supply the natural demand.

CHESTER-LE-STREET.—A deputation of omnibus drivers employed by the Northern General Transport Company has asked the Urban Council to restrict the number of licences issued to competing services, as competition had resulted in the company reducing the number of drivers.

GLASGOW.—The City Council have asked the Tramways Extension Committee to consider a petition requesting the Corporation, owing to the stoppage of the subway, to run motor omnibuses from Patrick Cross to Pointhouse for the benefit of workmen.

HUDDERSFIELD.—Huddersfield Corporation opened an omnibus service from Honley to Holmfirth and Holmebridge on April 15 when the members of the Tramways Committee, Mr. A. A. Blackburn, the general manager, and members of the staff travelled by the new service to Holmfirth. There they were joined by the chairman and members of Holmfirth Urban Council. Councillor Tinker, in welcoming the representatives from Huddersfield, said that they were inaugurating a service which was bound to be a benefit to both communities. The vehicles were supplied by Karrier Motors, Limited, of Huddersfield.

KEIGHLEY.—Reporting on the result of running three hired omnibuses on certain routes in order to improve the service, the chairman of the Tramways Committee has stated that during three months there had been a loss of about 2d. per mile owing to bad weather. The Tramways Committee have decided to purchase two of the vehicles at £1,575 each.

MACCLESFIELD.—The British Automobile Traction Company have inaugurated new services to Buxton, Glossop, Prestbury, Stockport, and Wilmslow.

RIPON.—The United Automobile Services, Limited, have offered to provide omnibus services between Ripon and neighbouring towns if the sum of £2,500 is subscribed. The amount promised at the end of April had reached nearly £2,000.

SOUTHPORT.—A sub-committee of the Tramways Committee report that it is undesirable to substitute omnibuses for the tramway service, owing to the heavy expenditure required for omnibuses, the extra capital and maintenance cost on the roads as compared with the present maintenance of the tramway track, and the loss to the electricity undertaking in revenue. There were no districts in the borough, they added, where it would at present pay to run omnibuses as an adjunct to the tramways.

WARRINGTON.—The Corporation Tramways Committee received a letter from the Lancashire United Tramways, Limited, requesting them to reduce the sum of 1½d. per passenger payable by the company in respect of the running of their omnibus service between Irlam and Warrington, in so far as the same related to workmen's fares. The committee declined to concur.

TORONTO OMNIBUS EXPERIMENT.

BRITISH V. AMERICAN TYPES.

For the purpose of linking up suburban areas with the city, the Toronto Transportation Commission are conducting an experiment with British, U.S.A., and Canadian omnibuses. The first-named are represented by the Leyland, A.E.C., and Tilling-Stevens machines, while the American vehicles are the Pierce-Arrow, and those of the Fifth Avenue Omnibus Company. The Canadian make is the Veteran. Each type is constructed so that it can be used either for single or double deck operation. A feature of the A.E.C. and Leyland is that the stairs come directly behind the driver. The Fifth Avenue machines are of the front pay-as-you-enter type. In the Veteran the inside passengers leave at the front. Arrangements are also being made to experiment with railless trolley cars.

MOTOR TRAFFIC NOTES.

PLENTY OF MOTOR FOREMEN.—Southwark Borough Council have appointed a new motors foreman at a salary of £21 9s. 4d. per month. They had 252 applicants for the position.

CHEAPER HAULAGE.—Annual tenders received by the Durham County Council show a decrease of 16 per cent. on last year's prices for mechanical haulage and 25 per cent. decrease on horse haulage.

MUDGUARDS FOR MOTOR VEHICLES.—South Shields Corporation have had guards fixed to their motor vehicles, the devices being of a similar make to those used on the North Eastern Railway Company's omnibuses.

A LOADING BY-LAW.—Burnley Watch Committee recommend the Corporation to make a by-law that "no person shall pack any box, hamper, cask, bale, or skip, the falling of which might occasion injury to persons in the thoroughfare, in or upon any cart, wagon, or trolley vehicle without effectually securing it."

CARS LOANED FOR A BISHOP'S JOURNEYS.—The Ipswich Diocesan Board have compiled a list of sixty-two motor car owners willing to place their vehicles at the Bishop's disposal on certain days. In a letter of thanks the Bishop states that he has enjoyed the system for two months, and nothing could be better.

MUNICIPAL MOTOR DEMONSTRATION.—In connection with the annual meeting and conference of the Institution of Municipal and County Engineers, to be held at Cardiff on June 21-24, a demonstration of motor vehicles used in municipal work will take place. As far as possible the machines will be shown under working conditions.

DANGEROUS STORAGE OF PETROL ON OMNIBUSES.—Much damage from fire was sustained by an omnibus running from the Intake tramway terminus (Sheffield) to Killamarsh. The outbreak is supposed to have been due to a passenger dropping a lighted match on the floor near the back seat, where tins of petrol were stored.

ELECTRIC RUNABOUTS FOR BOURNEMOUTH.—Two electric runabouts are to be purchased by the Corporation for the purpose of carrying passengers to and from the bathing huts and beach on the Undercliff Drive. It is stated that the cost of operation will be 2d. per ton-mile, with current at 2d. per unit, while a petrol vehicle would cost 9d. per ton-mile to run.

SLOUGH MOTOR DEPOT.—It has been stated in the House of Commons by the Financial Secretary to the Treasury that the approximate total expenditure by the Government on the Slough motor repair works is £2,500,000. This establishment, it will be recalled, was set up when the German army broke through the British front and captured a large repair depot.

POST OFFICE ELECTRIC TROLLEYS.—The Chester postmaster has inquired if Chester City Council object, from the point of view of street traffic, to the use of electric trolleys or tractors for hauling mails between the sorting office and the railway station. The Watch Committee have decided to raise no objection on the understanding that the vehicles are fitted with rubber tyres.

RIVAL OMNIBUSES AT HULL.—At Hull Watch Committee a deputation of motor omnibus proprietors in the city attended to protest against the granting of licences to omnibus proprietors from other districts who were not ratepayers of Hull. The committee however, adhered to their previous practice, which is to deal with each application from outside proprietors on its merits.

STANDARDISING COACH FARES.—The South-Western and South-Eastern sub-divisions of the Motor Coach Section, Metropolitan Division of the Motor Trade Association, have adopted standard tariffs for 1922. Similar action is being taken in other parts of the country. Eighty undertakings, including omnibus companies running coaches, have agreed to the new tariffs, but trouble is expected from several large owners who refuse to accept the rates.

LEYLANDS SAVE GLASGOW £1,000.—In regard to a proposal to convert a horse-drawn fire escape into a motor vehicle, Glasgow Watch Committee now report that Messrs. Leyland Motors, Limited, have offered to fit the escape on the new motor pump which the firm are now constructing for the Corporation, instead of the usual brackets and ladder, without extra cost. The committee state that the offer will result in a saving to the Corporation of about £1,000.

COMPLETION OF ROAD CLASSIFICATION.—In the House of Lords, Viscount Peel stated that the classification of roads had now been completed. There were 22,189 miles of Class I. roads and 14,400 miles of Class II. roads, out of a total of 177,306 miles of roads. For the current year 50 per cent. of the approved expenditure and maintenance of first-class roads would be paid out of this fund, so that on these roads there was a half and half payment. Something like £7,000,000 out of the £8,500,000 would be expended on the roads.

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MOTOR TRAFFIC

SPARK ARRESTERS.—At a recent meeting of the Highways Committee of Hertfordshire County Council it was reported that the Home Secretary had been informed by the Ministry of Transport that they doubted whether there was any power to make a by-law requiring the provision of spark arresters under the Locomotives on Highways Act, but a Departmental Committee of the Ministry is inquiring into the desirability of requiring such provision.

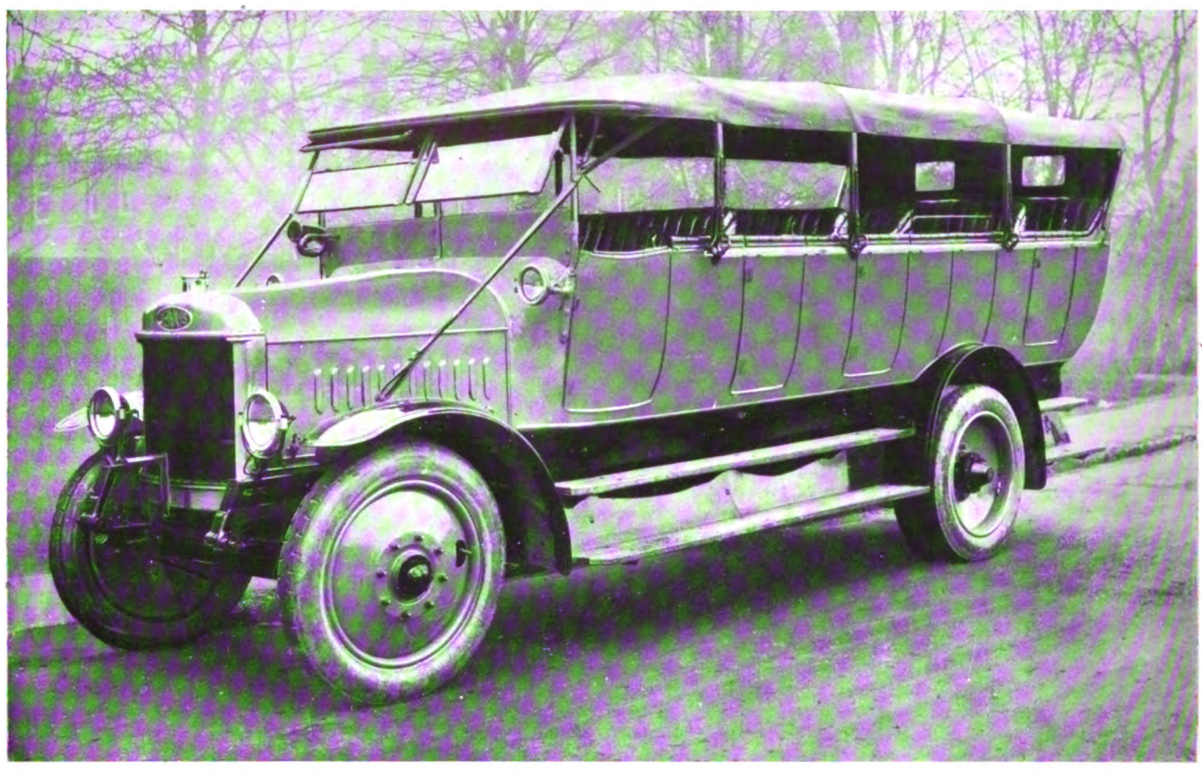
ALCOHOL FUEL FOR LONDON USERS.—As a result of the withdrawal of the Excise Regulations on the use of alcohol for power purposes, the Hammersmith Distillery Company have produced a motor spirit which can now be delivered in London and vicinity either by tank wagon or in 50 gallon barrels. For quantities up to 1,000 gallons weekly the price is 1s. 8½d. per gallon; for quantities between 1,000 and 2,000 gallons weekly, 1s. 8d. per gallon; and for more than 2,000 gallons a week, 1s. 7½d. per gallon.

EASTER OMNIBUS TRAFFIC.—In spite of inclement weather during Easter the London omnibuses carried 500,000 more passengers than last year over the four days. The fact that there were no unwieldy queues at the termini is due to the improved organisation of the central traffic control, and to the availability of more and larger omnibuses to deal with emergency traffic, which is a feature at holiday time. The company are running many more rural services this year. During Easter over 70 of these services were in operation.

A SUBSTITUTE FOR ROAD WATERING.—Marylebone Borough Council have accepted an offer by the Anglo Mex Oil Company to supply a sample barrel of bitumen solution, which, it is stated, can be mixed with water and applied to road surfaces. It is claimed that the solution has the effect of keeping the road surfaces damp and that the roads will probably only require watering once a day. The Council propose to make a trial on a short length of roadway, and report that should the solution prove suitable in all respects its use generally may be advantageous in the event of water shortage.

BRISTOL COMPANY WITHDRAWS CAB SERVICES.—During the past two years the Bristol Tramways and Carriage Company have ceased to work their motor cabs at Cheltenham, Weston-super-Mare, Gloucester, and Bath. At the annual meeting on April 6 the chairman stated that they were forced into that position because their patrons in those places could not afford to pay such charges as would meet the cost of working, etc. The drivers were given the opportunity of taking the cabs over, and had been working them at their own cost and risk. They had to work longer hours, to wash their own cabs, and do a lot of things that they would not have been willing to do when the cabs belonged to the company.

HEAVY VEHICLE RESTRICTION ORDERS.—At the annual meeting of the County Councils' Association, held in London on April 26, Lord Strachie was elected president. In his address Lord Strachie said a matter of the greatest importance was the serious increase in the cost of road construction and maintenance with which rural highways authorities were faced in consequence of the extended use of heavy mechanically-propelled vehicles. A considerable proportion were engaged in through traffic between large towns, and did not benefit the rural districts. Finance was the dominant factor in the situation, and it was essential that the Ministry of Transport should give the most favourable consideration to applications by highway authorities for orders prohibiting or restricting the use of heavy motor vehicles over roads unsuitable for the traffic.



A Dennis Motor Coach on Pneumatic Tyres, Seating 18-20 Passengers.

IMPROVED ROADS AT BLACKPOOL.—Mr. F. Wood, borough engineer of Blackpool, described at a meeting of the North-western District of the Institution of Municipal and County Engineers the method of re-surfacing roads to withstand heavy traffic. It was nothing unusual, he said, for about 300 motor coaches to arrive in the course of a morning, and there were in the town about 150 running over the roads on short and long trips all day long. The macadam roads, which had been attended to at Easter, 1921, had to be repaired in the following September at a cost of about 4s. per super yard. He had now laid a two-coat bituminous surface, and the cost was working out at about 9s. 6d. per super yard, so that this form of road, if it only lasted two years, would be cheaper than ordinary macadam. The eventual cost of maintenance would probably be little more than pre-war cost, especially if the tonnage of traffic was taken into consideration. The taking out of the crown and shaping the road, so that vehicles could negotiate corners and turns with proper elevation and use the sides of the roads, was a great advantage.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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NOTES ON RAILLESS ELECTRIC TRACTION.

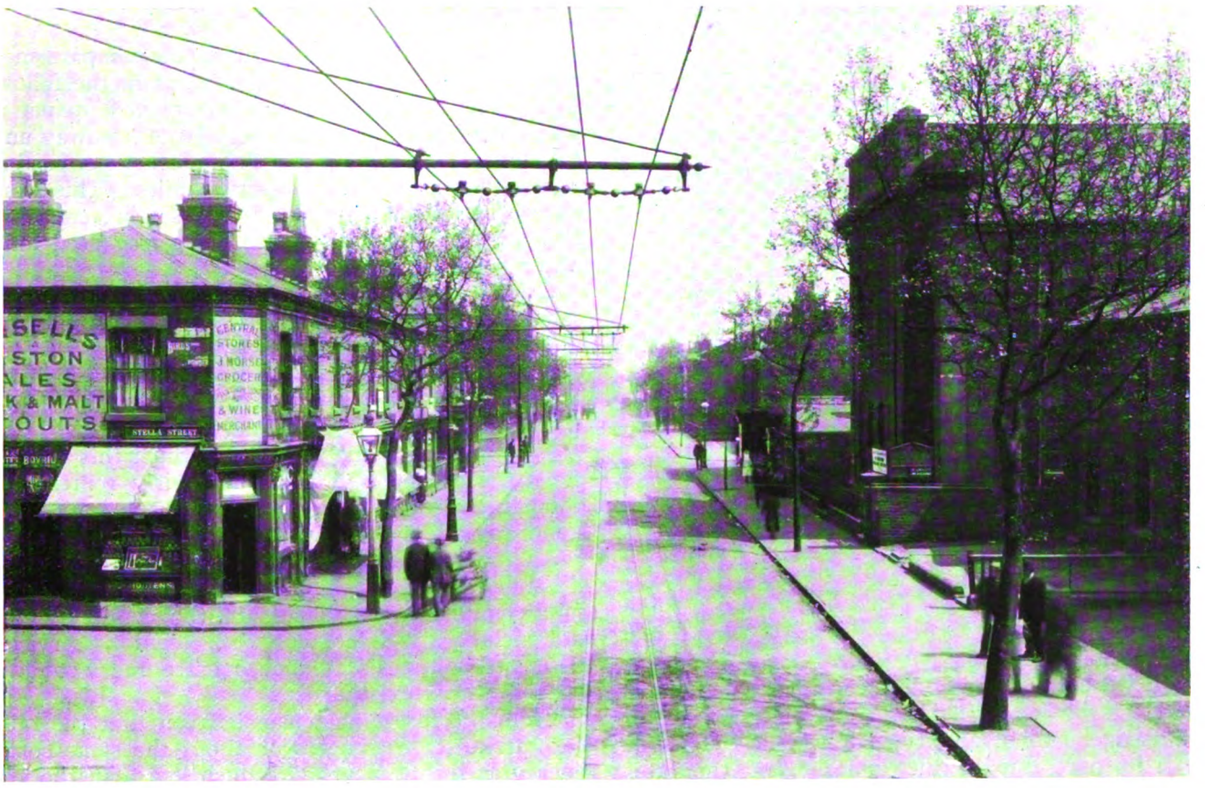
By E. M. MUNRO, M.I.E.E., M.I.Mech.E.

(A paper to be read at the Congress of the Tramways and Light Railways Association at Bournemouth.)

Railless electric traction has come to be accepted by numbers of officials who are responsible for the operation of public passenger services as offering a possible solution to some passenger transport problems not readily met by the older established methods. The development of this form of transport reached the stage when its reliability and cheapness were demonstrated at a time when it became clear that the increased costs of constructing new tramways, and in some cases the outlay necessary to rehabilitate existing routes could not be undertaken on a remunerative basis.

The alternative of the petrol or petrol-electric omnibus has been widely adopted, and the results are testimony that this form of transport will retain its popularity wherever revenue and conditions favour it. Railless electric traction, too, has its not inconsiderable field which will no doubt be enlarged as its adaptability becomes more widely demonstrated.

An examination of the characteristics of the railless car yields some interesting results. In the following notes it is proposed to traverse the subject by an analysis of the principles involved with some data put together for this purpose, and brief reference will be made to types of cars already constructed and in daily service from which the particulars here given have been obtained. Certain data relating to tramcars and petrol omnibuses have necessarily been included to show where the railless car stands. The various matters considered are perhaps dealt with upon rather general lines, but the breadth of the subject necessitates such treatment to bring it within the limits of this



View of Overhead Wiring for Railless Traction on Birmingham Converted Tramway.

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contribution. The discussion will no doubt amplify such portions as are of interest amongst the following—

Capacity and speed,	Types of vehicles,
Cost of installation,	Power,
Operating costs,	Conclusions.

CAPACITY.

The number of seats in a mechanically propelled road car is limited by the axle loads permitted and the width and length of bodies allowable. Typical seating plans are shown in Figs. 1, 2 and 3—the first single-deck cars and the last two double-deck cars.

Table I. sets out the particulars of these cars compared with similar data in respect of other forms of passenger vehicles with the object of fixing the position of the railless car in the scale of capacities.

These cars represent types which are in daily service maintaining regular schedules.

TABLE I.

Type of Car.	Weight Unladen. Tons.	cwts.	qrs.	No. of Seats.
Railless.				
Single-decked Car ...	4	10	0	28
,, ...	5	3	0	36
,, ...	4	0	0	24
,, ...	4	18	0	29
Single-decked Car—Average	...	...		355 lbs. per seat.
Double-decked Car ...	6	16	0	51
,, ...	7	8	0	51
,, ...	7	4	0	59
Double-decked Car—Average	...	...		297 lbs. per seat.
Tramcar.				
Single-decked Car ...	14	8	0	36
Single-decked Car ...	...	...	...	896 lbs. per seat.
Double-decked Car ...	13	14	2	72·74
,, ...	10	19	1	58·60
,, ...	10	16	2	58·60
,, ...	13	5	3	72·74
,, ...	14	8	0	74·76
,, ...	14	14	2	78
,, ...	13	14	2	62
,, ...	15	15	0	62
Double-decked Car—Average	...	...		440 lbs. per seat.
Petrol Omnibus.				
Single-decked 'Bus ...	4	6	0	24
,,	5	10	0	28
Double-decked 'Bus...	4	17	0	34
,,	4	10	0	57
,,	4	17	1	37
,,	4	17	3	38
Petrol Omnibus Average				296·9 lbs. per seat.
,, ,, (double-decked)—Average...				256·4 lbs. per seat.

From Table I. it will be seen that the double-decked petrol omnibus has the lightest weight per passenger seat of any type of vehicle considered. This is in part due to the inclusion of the latest form of omnibus designed for service in the metropolitan area. To what extent the form of construction used in the design of the bodies of such vehicles could be generally applied in other services is not here under consideration. Hitherto it has been deemed expedient to have bodies built to a scantling somewhere between this and the tramcar body for railless services over provincial roads; the difference is, however, not great, and it is of interest to have this example included from a purely structural point of view.

As to capacities, we can see that the railless car has increased from 28 to 59 seats, at which figure it must stand if the 5-ton axle load is to be the maximum pending results of further developments in design with the object of reducing proportion of total load per axle.

Table II. gives certain data by means of which the approximate cost of energy per passenger mile can be ascertained.

TABLE II.

Type of Car.	Energy per car mile.	Average Passengers carried per mile on 38% seats.	Cost of Energy per car mile at 1½d. kw.h.	Average Speed m.p.h.	Cost of Energy per passenger mile.
Railless s.d. ...	1·00 KW.H.	11	1·5d.	8·0	·136d.
,, d.d. ...	1·66 KW.H.	20	2·49d.	8·0	·125d.
Tramcar ...	2·00 KW.H.	24	3·0d.	7·5	·125d.
Petrol Omnibus (petrol)	·166 gals.	13	4·359d.	8·0	·335d.

The above results are averaged from a number of examples and types examined for this purpose.

Column 2—Railless.—It will be seen that the energy consumption represents an expenditure of about 190 to 195 watt hours per ton mile, which includes line losses. The actual energy consumed at the car should not exceed 150 watt hours per ton mile on good average road surface, and with the improved bearings now being incorporated in the latest designs it is not expected that more than 140 will be recorded on the car if line volts are well up and the number of stops per mile are not excessive.

Column 3.—For the purpose of comparison the number of passengers was arrived at in the following way. The number of passengers picked up per mile was taken from the records of a large tramway undertaking, and the average length of journey per passenger assumed to be a little over two miles. This worked out at about 38 per cent. of the seating capacity of the car, the same percentage being also used for the other types of car.

Column 4.—Similarly for comparative results the same rate of charge for electric energy has been taken in each case, viz., 1½d. per KW.H.

Column 5.—The average speeds, including all stops, are those actually operated upon the systems from which most of these particulars were taken.

Column 6 gives the results for which this table was constructed, and will no doubt fairly represent the comparative expenditure of energy per passenger mile upon any average route.

As regards the data given for petrol omnibuses, these figures have been obtained from one of the largest municipal omnibus services in the country, but do not include any reference to the omnibus services in the metropolitan area which operate under conditions not elsewhere existing.

From the foregoing it can be seen that the railless car carries its passengers at about the same cost for energy as the tramcar, and much less than the petrol car, and that its capacity has reached the point where it can in this respect be considered in connection with all but the densest traffic, also that the average speed is a quite satisfactory feature.

It is, of course, not possible to find a common denominator for these different vehicles, therefore average examples have been selected from the preceding tables for Table II., and it is certain that the features disclosed would exist in some degree on any system where comparisons could be made.

Thus the railless car is an economic high-speed vehicle of adequate capacity, and the cost of installation and operation is, as we shall see, lower than for other

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forms of road traction within the limits of its economic application.

COST OF INSTALLATION.

So far the railless lines in actual operation have been constructed upon routes and for services which have not warranted the expenditure of the capital sums necessary for a tramway, and for that reason it is not possible to compare the effect of the great difference in capital cost between these two systems by a reference to the published figures for interest and sinking fund per car-mile. To get an idea of what effect this difference would have on these figures one must have recourse to estimates based upon similar requirements. As yet the only instance of such a case is that of an important installation in this country where a route at present operated by tramways is to be equipped with railless, and a city service of four minutes headway is to be maintained.

Here the published figures state that upon this $2\frac{1}{2}$ mile route the saving in capital cost is such that a loss of £3,000 per annum which would follow upon the reconstruction of the tramway track will be avoided, and instead a profit of £3,000 per annum is estimated to be available by the adoption of railless.

These notes are not intended to comment upon the actual cost of tramway track and overhead line equipment either for tramways or railless, but to illustrate the effect of the fundamental differences in construction between the two systems, also to introduce the statement that on less than a certain length of headway railless can operate more economically with its overhead line equipment than the petrol omnibus does without this expense.

The location of the critical point where the advantage is neither to the tramcar or railless has been worked out by Mr. R. H. Wilkinson, the general manager of

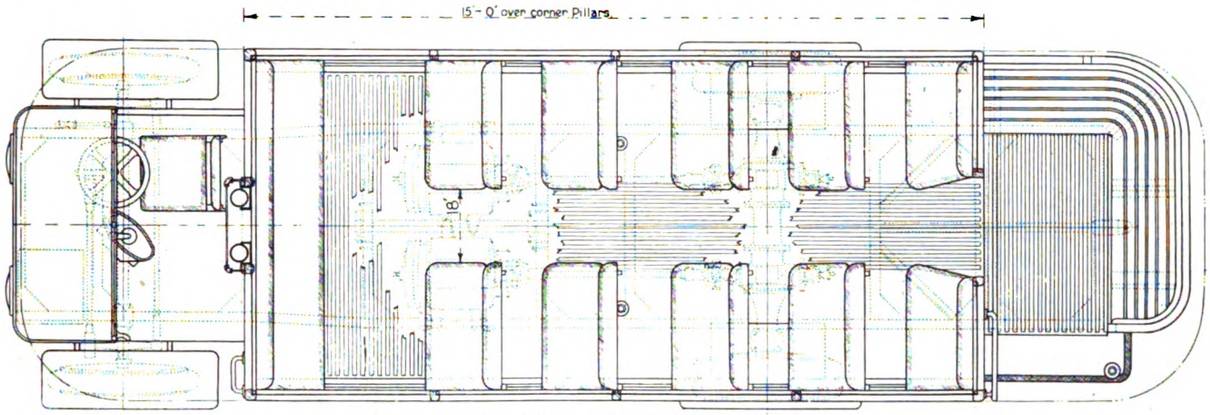

Fig. 1.—Seating Plan of Single-Deck Railless Car.

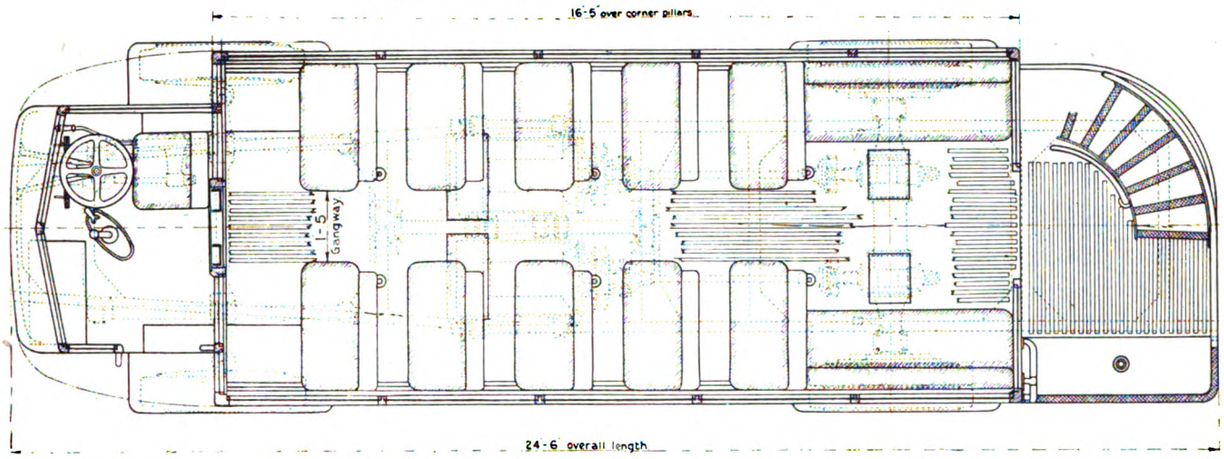

Fig. 2.—Seating Plan of Lower Saloon—Double-Deck Railless Car.

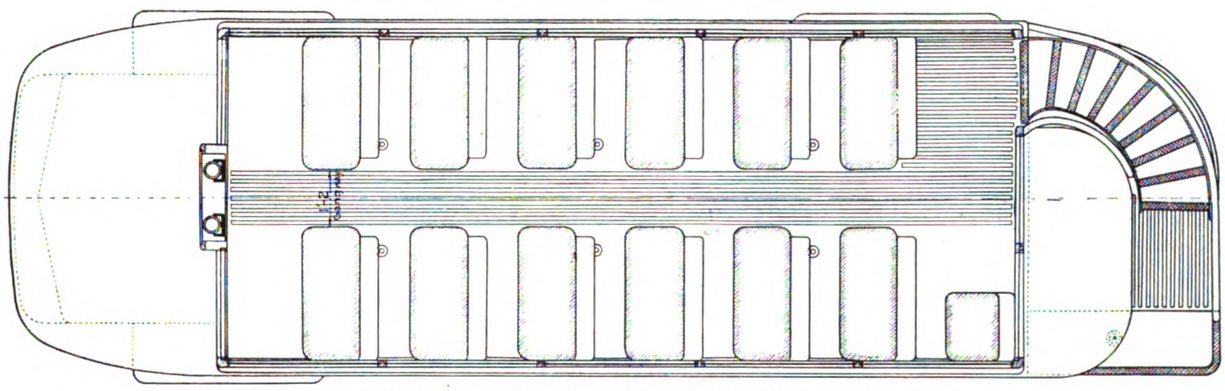

Fig. 3.—Seating Plan of Upper Saloon—Double-Deck Railless Car.

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the Bradford Corporation Tramways, as follows—

(*a*) Between single-line tramway and railless it is in the neighbourhood of a three-minutes service.

(*b*) With a two-minutes headway railless is more economical than a double-line tramway, but more costly than a single-line tramway.

The point at which the railless car ceases to be more economical than the petrol omnibus in regular service has been variously estimated between 30 and 45 minutes' headway. Mr. C. J. Spencer contributed an article in which this was dealt with at the June 1913, meeting of the Managers' Section of the Municipal Tramways Association, and at that time placed this point somewhat higher.

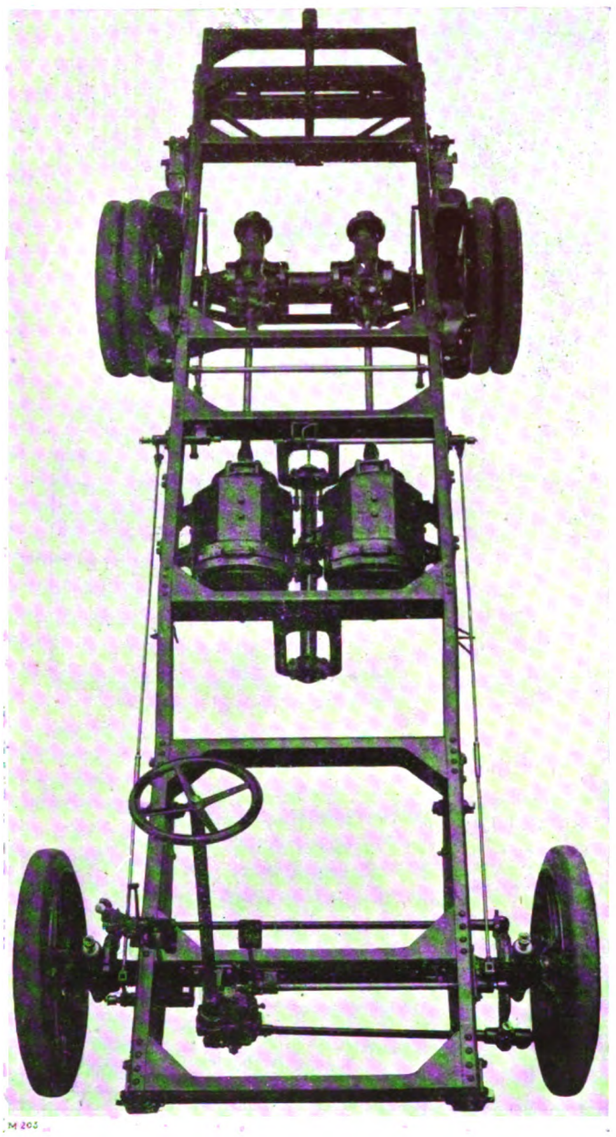

Fig. 4.—Plan View of Chassis of Single-Deck Car.

At the present time the cost of materials and labour move so freely that an exact estimate could probably only be made upon some specific set of conditions; but the principle would stand, and no doubt determine the critical headway within the figures given.

On these bases between the 3 minute and 45 minute headway railless cars have the advantage in economy of operation; on longer headways the petrol car, and on shorter headways the tramcar is more economical.

The factors from which these results proceed are—

High average speed of railless cars and longer life as compared with the petrol omnibus.

Saving of cost of track, notwithstanding increased cost of overhead line, as compared with the tramcar.

OPERATING COSTS.

Operating costs for railless cars as compared with petrol omnibuses are lower on account of—

High average speed;
Smaller cost for power;
Relative simplicity of construction;
High overload capacity.

If petrol costs 2s. per gallon, and six miles per

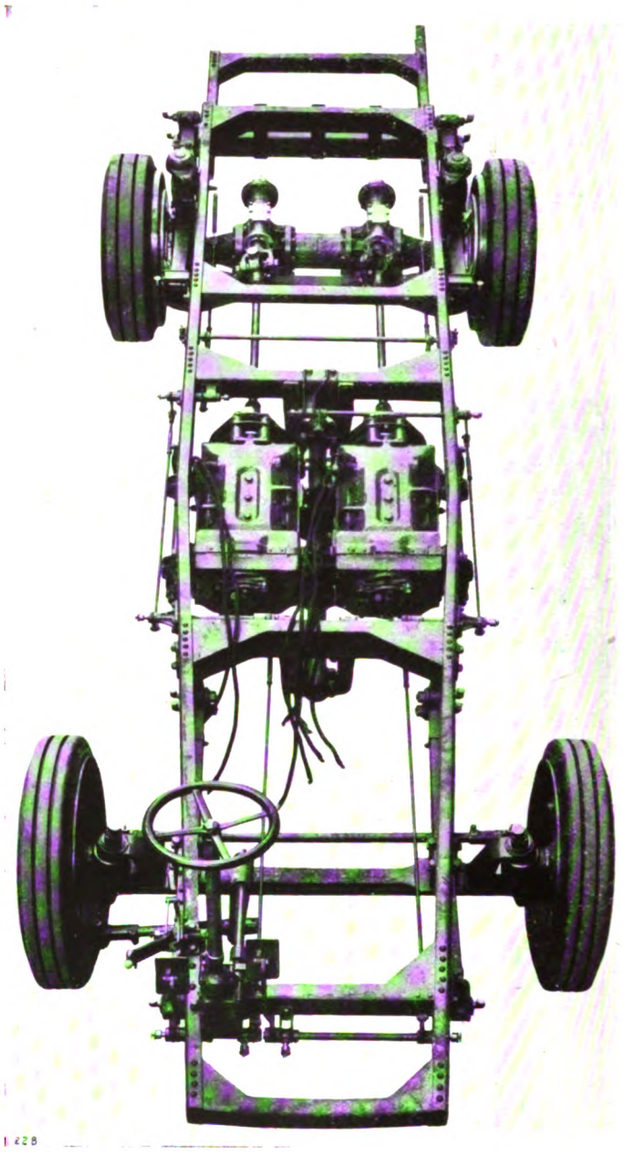

Fig. 5.—Plan View of Chassis of Double-Deck Car.

gallon is the work it does, the railless car at 190 watt hours per ton-mile costs 50 per cent. less with energy at 2d. per KW.H.

The increase in average speed is due to higher acceleration and extra power available on grades and under overload conditions as compared with the petrol omnibus; and in the case of the tramcar the higher travelling speed owing to the absence of checks due to slower moving traffic encountered.

The simplicity of construction lies in the employment

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of the electric motor as propelling agent, and the accompanying speed control, which is devoid of mechanical transmission of power, consisting as it does of simple mechanism for the regulation of the supply of current to the motors. For the rest, the chassis of a railless car is no more complex than that of the petrol vehicle; recent designs indicate that the adaptation of the chassis perfected for petrol drive for use on railless cars is expected to cheapen the latter in vehicles up to a certain size.

It may be of interest to state that in an actual railless schedule which is shortly to be operated the power to be taken by each car varies from 40 KW. to 100 KW. on level and on maximum grade under full load conditions in order to maintain an average of 8 miles per hour with seven stops per mile, the maximum variation in rate of expenditure of energy under all conditions is from 25 KW. to 100 KW.; 58·8 H.P. being the continuous rating of the motor equipment, 84 B.H.P. is the power at one hour rating, but if this conventional measurement is reduced to continuous rating, the range of power as actually needed for the performance of the vehicle is more easily compared with the range of power available from the internal combustion engine as a propelling agent. It is this natural range of power which enables railless cars to maintain a schedule speed not always possible with petrol omnibuses fitted with any commercial size of engine.

The single motor chassis is a more recent product than that with the two-motor equipment. It does in a number of cases offer advantages over the more economic series parallel control, chiefly owing to its simplicity and lower cost, which becomes effective where the service does not call for many stops per mile. Other claims for superiority are put forward on its behalf, such as reduction in maintenance costs and convenience in readily obtaining spare parts at low costs, this single motor being easily mounted in any good form of standardised petrol chassis, and further greater comfort in riding is claimed. In addition a longer life is assumed for the chassis by reason of the several parts composing it being the product of a long refining process by trial and error.

From the mechanical point of view these advantages are beyond question if the chassis is used for the service it was designed to maintain. From the electrical side one or two matters must be taken into account; e.g., the desirability of controlling the whole range of speed in one motor is not questioned where but few service stops are made, but if the stops are frequent it must be borne in mind that rheostatic losses are likely to be heavier, and if the cost of energy is a consideration, it may be worth while to ascertain what the increase in energy consumption may be.

The matter is this—series parallel control is economical in current consumption from two points of view. With two motors the rheostatic losses are at least one-half the losses in a single motor. In regular service of average character the ordinary rheostatic losses with two-motors series parallel control amount to about 15 per cent. of the total energy consumption on the car. If these losses are doubled the disadvantage of the single-motor system would be about 15 per cent. increase in energy consumption. In addition to this it must be remembered that in traffic it is often necessary to run at half-speed with series-parallel control-motors in series. This is effected with but the small reduction in motor efficiency due to the lower voltage drop across each motor; but with a single motor the half-speed must be got by inserting resistance in the motor circuit.

For the same pull produced by the motor with plain rheostatic control of a single motor the input to the equipment is just the same whether the motor is running at full speed or at half speed. If the efficiency at full speed is 80 per cent. at half-speed it is only 40 per cent.

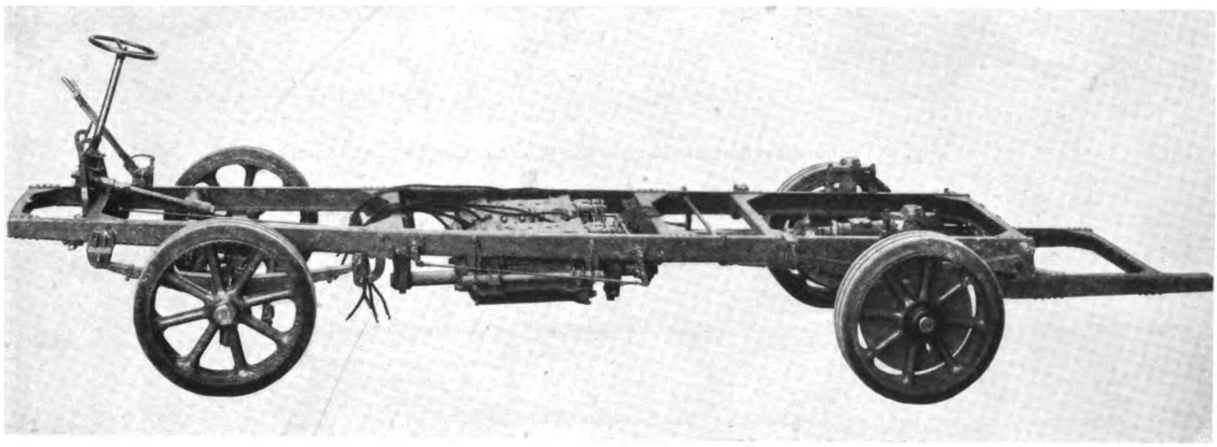

Fig. 6.—Side Elevation of Chassis for Double-Deck Car.

Railless cars requiring motors of more than 40 H.P. have not been constructed upon any of the well-known petrol passenger chassis designs, but have chassis specially designed for the transmission to wheels of powers not as yet usually employed on petrol chassis. Moreover with the limited headroom from roadway to floor of car it is very doubtful if a single motor could be conveniently got in. With the two-motor equipment mounted upon the chassis frame a conveniently low floor is available; the straight drive to each rear wheel is effected, and the front of the car left clear for the standard front axle and steering gear. Fig. 4 shows this form of chassis for a single-deck car with 30 seats, and Figs. 5 and 6 for a double-deck 50-60 seat car. In the former two 20 H.P. motors are used, and in the latter two 42 H.P. motors are required. The height of floor from the ground in these cars is

Single-deck car	3 ft. 1 in.
Double-deck car	2 ft. 11¾ in.

Figs. 7 and 8 show a single motor chassis for a 30-seat car.

Whilst cars of moderate seating capacity will no doubt continue to be employed upon routes running

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through more or less thinly populated areas, cars with large seating capacity are being constructed to meet the anticipated extension of the field of railless operation to more densely populated areas. Fig. 9 shows plans and elevations of one of these vehicles, Fig. 10 a back axle and Fig. 11 a motor; and it is confidently expected that much larger cars will be offered for public service in the near future.

POWER.

Power has already been referred to to ascertain the comparative expenditure in various types of cars commonly in use, as determined by the dead weight and passenger load. This further reference is intended to deal with the power installation, as determined by the nature of the service and conditions incident to transmission.

The recent increase in pressure at which current may be put into the line gives a little more latitude in the matter of drop than was previously consistent in good practice.

Six hundred volts is now permissible, and upon the assumption that motors wound for 525 volts may be worked at 450 volts, we have upwards of 25 per cent. drop in trolley wires and feeders wholly or in part available, according to the relation of cost of energy and cost of copper. This is important to railless traction, since theoretically about four times the amount of copper is needed for railless as compared with tramways if the same losses are held to.

Past practice has held modified views on this point, but in the event of railless being employed for fast services at short headways with heavy cars, the exigencies of such service will necessitate a more accurate balance being struck between the cost of power and the cost of copper. What happens on grades is of interest, as the following notes will show.

The coasting grade for a railless car should be taken at about 3 per cent. to cover variations due to weather conditions and other causes; thus $3 \times 22{\cdot}4 = 67{\cdot}2$ lb. per ton is indicated as the tractive effort due to gravitation pull on this grade, the equivalent of which must be supplied by the motor equipment on the level to overcome resistance to traction, and it might be assumed that on an undulating or switchback route where the grades do not exceed this figure, the average energy on the round trip flattens out to approximately mean consumption upon a level route, but where the number of service stops necessitates a travelling speed on the level which approaches the maximum allowable, and as it follows that the speeds downhill may not legitimately exceed that figure, the speed on up grades is not to be arbitrarily settled; it is, in fact, controlled by the maximum on level and down grades. It is in such cases that the advantage of the great range of available power on all trolley vehicles is so apparent.

To take a concrete case where a double journey of 5 miles total approximately has 2,600 yards on up grades and 1,660 yards on level or down grades one way, the rise on the home run is 166 ft., or a mean grade of 2·14 per cent, the service has to be maintained with nine cars with seven stops per mile, and lay-over necessitating a 36-minute allowance for the trip. This

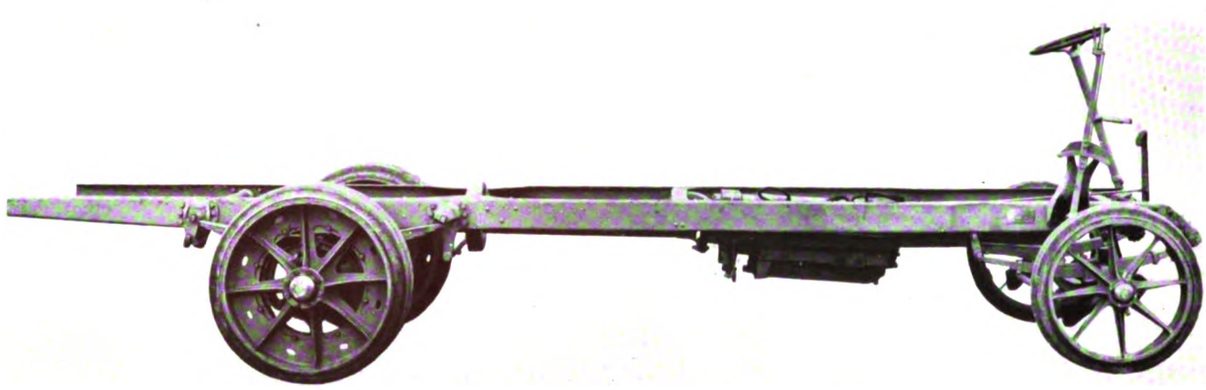

Fig. 7.—Side Elevation of Chassis for 30-Seat Car (Single Motor).

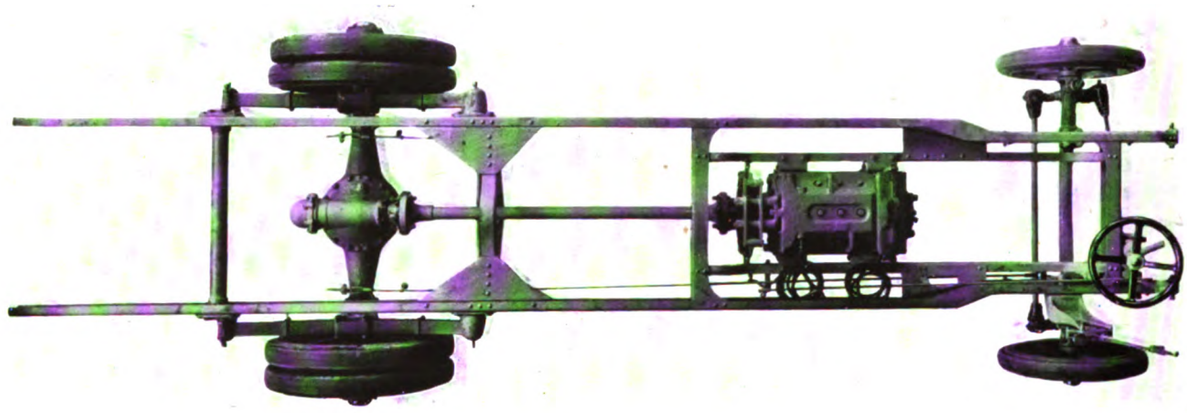

Fig. 8.—Plan View of Chassis for 30-Seat Car (Single Motor).

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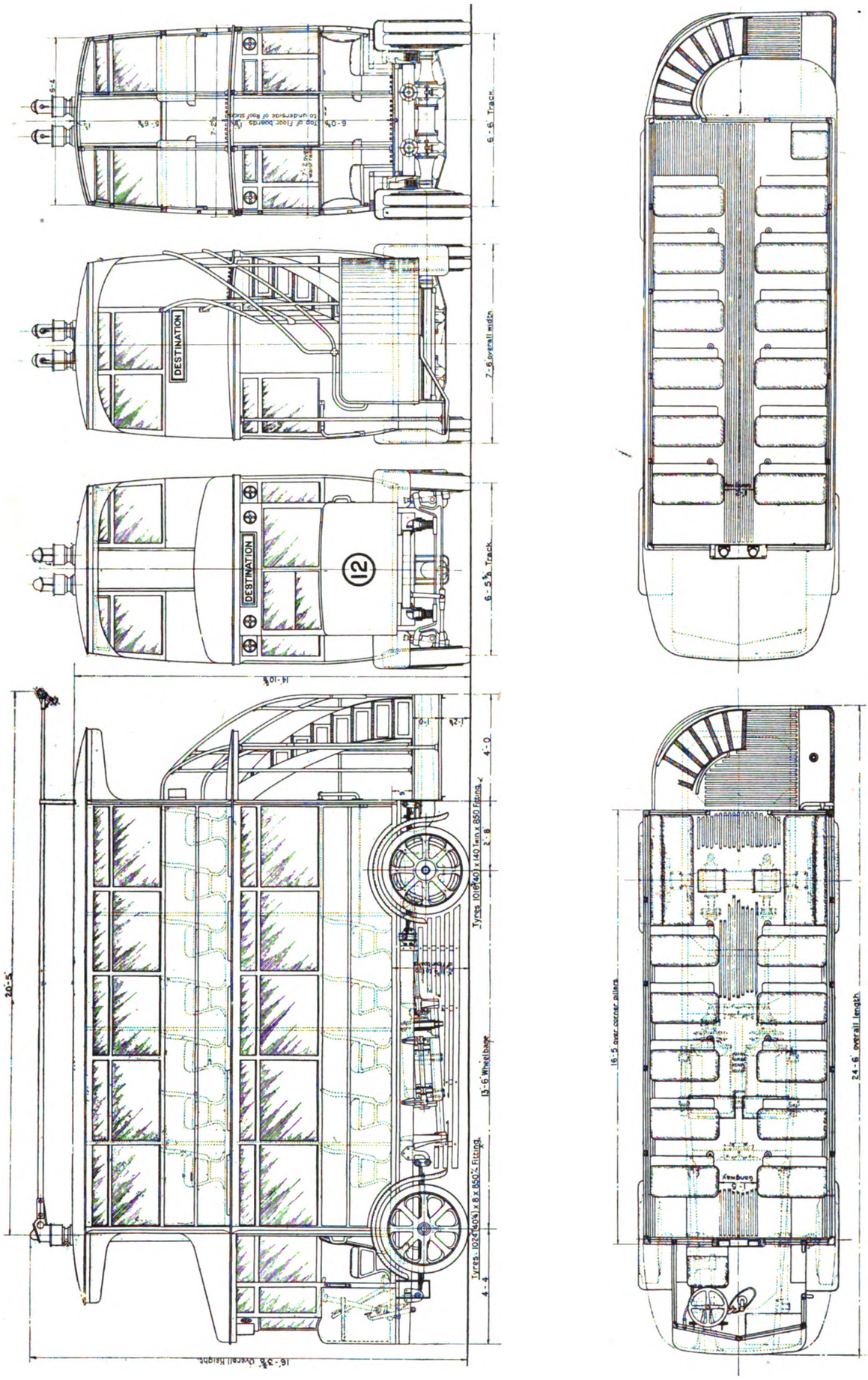

Fig. 9.—Elevations and Plan of Covered Top Double-Deck Railless Car—Birmingham Corporation Tramways.

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equals a mean speed of 16·6 miles per hour on grades. On grades the mean drawbar pull on a railless car, 10 tons loaded, equals 1,180 lb.; the mean drawbar pull on a tramcar of similar capacity with 51 passengers, having a loaded weight of 13¾ tons equals 1,072 lb. Although the resistance to traction for the tramcar is taken at less than one-half of that for the railless car, this close approximation is due to the difference in

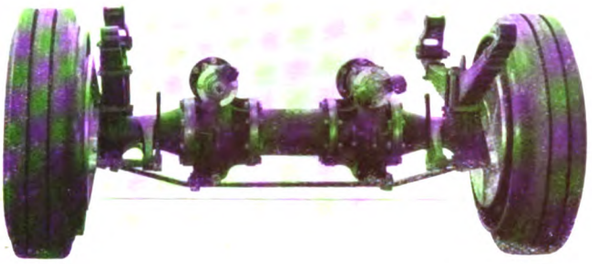

Fig. 10.—Rear Axle for Double-Deck Railless Car with Separate Drive for Each Wheel.

the unladen weight per passenger-seat of the two vehicles.

To accelerate these two cars at 1 ft. per second per second on the 9 per cent. grade, of which there is a short piece, the railless car needs a drawbar pull of 3,416 lb., whilst the tramcar requires a pull of 4,146 lb. Running on the level the drawbar pull for railless car equals 700 lb., and the tramcar 412 lb. On such a route as the one described the energy consumption should not vary much between the rail and the railless car.

With regard to the power actually taken by railless cars, some misconception existed when this form of traction was first projected in this country, it being thought that the increase in energy consumption would be comparable to the increase in the resistance to traction upon the surfaces of public roads over that upon the grooved tramway rails, between which there is a great difference. Whereas the particulars set out in Table II. show that no such differences exist if

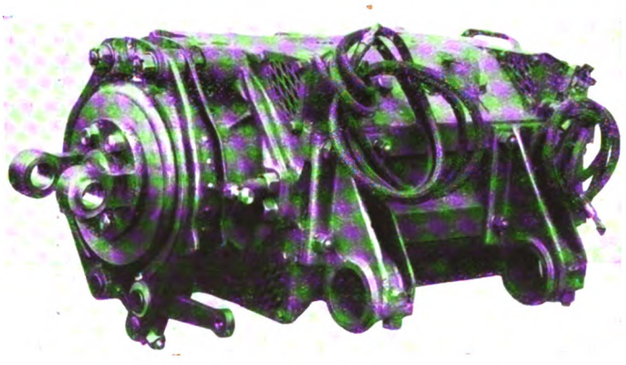

Fig. 11.—Motor for Double-Deck Car with Emergency Brake.

considered upon the basis of passenger miles, which seems a fair method of comparison.

Where a schedule has to be guaranteed and the headway is short, or where energy consumption has to be specified, an ample figure for road resistance should be taken.

The resistance to traction may well be a varying factor as between one route and another, at any rate until roads are constructed upon some standardised plan, and so maintained that the surface can be anticipated to offer a resistance varied only by weather conditions. For this reason, where possible, voltage conditions should be variable between some narrow limit such as may be practicable, although the selection

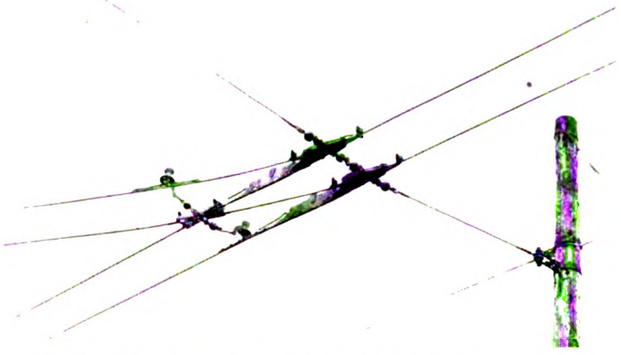

Fig. 12.—Insulated Fitting in Overhead Line to Effect Junction of Closed Locp.

of a sound figure to cover road resistance will always put this matter upon a safe basis.

As these notes do no more than touch upon the essences of railless traction rather from an economic point of view with an engineering explanation than a detailed account of construction, it will suffice to make only a brief reference to overhead line equipment. This is on all fours with that used for tramways. The apparent difficulties of running an earthed negative through complexities of 550 volt positive wires were not so real as they looked. Two-pole overhead line can be constructed with the same facility as the single-pole overhead line in tramways by due observance of a few essential matters.

Fig. 13.—Cam Controlled Trolley.

Fig. 12 has been introduced here to show an insulated overhead line fitting designed for effecting the junction of a closed loop where the polarity was of necessity changed. The inner or near wire being positive returns by way of the other side of loop, and makes a junction with the further and negative wire.

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This fitting was erected for test over a 1-in-9 grade, and a car weighing 8 tons was driven up this grade past the junction on to the main line without the controller being shut off; no arc was drawn over the fitting, and repeated trials failed to damage it. The normal gauge of break on the wires was not varied and a quite inconsiderable length only made dead, as illustrated in Fig. 12.

As to current collection, contact with both wires can be maintained with any well-made trolley of a suitable form up to deviations of say 10 ft. at moderate speeds with adequate upward pressure on trolley wires.

For wider reach-outs a special trolley has been designed (Fig. 13) to operate with poles at right angles if necessary at any speed without de-wirement and with low upward pressure on trolley wires; e.g., used with 20 ft. poles, 17 ft. or more on either side of the trolley wires can be reached with ease, giving free control of a 40 or 41 ft. road. This is all the mobility required of any route-bound vehicle. By this means an oncoming car can pass any slow-moving or stationary vehicles, if necessary running as much as 34 ft. away from the kerb of footpath, according to the relative

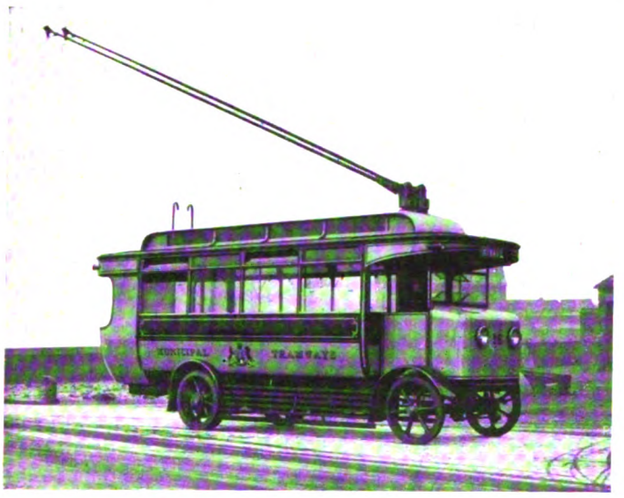

Fig. 14.—Front and Side View of Bloemfontein Car.

situation of overhead wires; also these deviations can be made acutely if so required. Hitherto such wide reach-outs have not been necessary, but with the employment of railless in the main thoroughfares of big cities more scope will be required in this direction.

CONCLUSIONS.

In general the characteristics of the railless car appear to be—

(1) Low dead weight per passenger.
(2) Low cost for energy per passenger mile.
(3) High average speed.
(4) Low capital charges.
(5) Low operating costs.
(6) Ability to operate on heavy grades.
(7) High overload capacity.

These advantages may not appear in violent contrast when compared with those of other systems of road transport in every case, but it seems certain they will exist in some degree between wide limits of application. Whether or not that degree warrants the adoption of this form of traction is matter for consideration after careful scrutiny of all the local conditions.

It is hoped these observations will promote discussion. Endeavour has been made to show the railless car in what is believed to be true perspective, and to indicate the grounds for its claims to usefulness between the heaviest traffic and the service which will not pay for overhead line equipment.

In conclusion, the author acknowledges the valuable assistance derived from the particulars embodied in Tables I. and II. received from Mr. A. L. C. Fell, the general manager of the London County Council Tramways; Mr. R. H. Wilkinson, the general manager of Bradford Corporation Tramways; Mr. Sykes, the general manager of Rotherham Corporation Tramways; and Mr. A. C. Baker, the chief engineer of Birmingham Corporation Tramways. and also the drawings and photographs lent by Messrs, Railless, Limited, London contractors for railless electric installations.

MODERN IMPROVEMENTS IN ROLLING STOCK.*

By C. J. SPENCER, O.B.E., M.I.E.E., M.Inst.T.

My hearers will probably remember that at a conference of this Association held in London in July 1920, I had a little to say on the question of improvements in tramway rolling stock as a result of my recent visit to the United States of America, and whilst I did not find anything like unanimity of opinion on the questions then raised, it is gratifying to know that my somewhat provocative remarks have been noted and quoted for various purposes. Let the above stand by way of introduction to the subject which I have the honour to introduce for discussion to-day.

I am afraid that a "candid sceptic" might say that the title of the paper is a misnomer; that no such thing in reality exists; that there have not been any improvements in tramcar rolling stock since about 1900 or a little earlier, about which date the electric car became a common sight in the streets of almost all our large towns and cities. At any rate, the few new cars that have appeared in the post-war period do not differ vastly from the cars of the pre-war period. I am sure you will agree that the above remarks represent the facts, and that for some strange reason the cars of to-day, with the exception of some very minor details, are almost exactly of the same type as those manufactured and put into service some 20-25 years ago.

What, however, is perhaps even more important than the statement of the layman that the cars appear to be the same; they are, in fact, the same, and the detailed mechanism, with perhaps some notable exceptions, is very much as it was. In a word, the expert fully confirms the observations of the man in the street.

The above, whilst being generally true of this country, cannot be said to be absolutely true of some foreign systems, but that was fully discussed at the Congress previously mentioned.

The question then arises—Have we in this country a good and satisfactory explanation of this extraordinary state of affairs?

I suggest that investigation of the subject might proceed somewhat upon the following lines—

(1) Was the design of tramcars 25 years ago so excellent and perfect that nothing further can be done in the way of improvements?
(2) Is there some unsurmountable obstacle (technical or otherwise) to radical improvement?

* A paper to be read at the Congress of the Tramways and Light Railways Association.

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(3) Have we come to the conclusion that the tramcar is a thing of the past, and that a rubber-tyred vehicle, as contrasted with a rail-borne vehicle, is so greatly superior for street transport purposes that it is waste of time further to develop the rail-borne variety?

Dealing with the above seriatim, I am sure the answers to (1) and (2) are in the negative.

I am afraid that (3) cannot be answered quite so readily, and it is necessary to go into some detail.

The development and improvement of the rubber-tyred vehicle during the last ten years has undoubtedly modified the views of transport men. There are many routes where to-day the traffic is handled by tramcar which could be operated, to say the least, to greater public advantage by rubber-tyred vehicles, and, under some circumstances, more economically, whether the rubber-tyred vehicle be of the self-contained or of the railless trolley type. On the other hand, there are in many districts other circumstances where a large vehicle carrying anything from 70-100 passengers, and necessarily rail-borne, is required to deal adequately with the traffic. In fact, even with vehicles of this capacity peak load traffic is not satisfactorily handled, and much larger units are required.

It is impossible, of course, to dogmatise on the possible development of the rubber-tyred steerable vehicle capable of carrying, say, 150 to 200 passengers, but without going into further detail I venture to say that, as far as one can see, the limits to the possible capacity of a rubber-tyred, road-borne vehicle are not so great as those of a rail-borne one.

The question, however, is a two-fold one. With a certain critical density of car-miles per mile of route the total cost per car-mile (including capital charges) per passenger carried is less with a rail-borne than with a rubber-tyred vehicle. There are great economic advantages in a system where heavy loads are carried on a steel rail with power supplied from a central station using home-produced fuel as contrasted with a system of carrying a power station on each vehicle.

This interesting phase of the question could, of course, be pursued much further, but this is a paper dealing with tramcar rolling stock, and is not primarily concerned with the merits of any particular vehicle, except in so far as the question arises as to whether the rail-borne street vehicle has a future at all.

In dealing with question (3) I believe that in the view of many transport men, both tramway and otherwise, the tramcar is by no means obsolete, and therefore time would not be wasted in considering the possibilities of improvement and development. It would, however, I venture to submit, be perfectly true to say that improvements in tramcar design and methods are urgently necessary if the tramcar is to retain even its present position in street transport. I think we may take it for granted that improvement in tramway rolling stock is not only possible, but desirable, so we may proceed to examine some of the points which certainly require consideration.

The man in the street will tell you that the tramcar is a noisy and from a modern point of view a slow, cumbersome and altogether inconvenient means of travel.

Elimination of Noise.

There is no doubt that a steel wheel running on a steel rail must inevitably create more noise than a rubber-tyred wheel on an ordinary road surface, but I am not sure that we need have as much noise from this source as we have to-day. Can it be said that we have given full consideration to the merits of a wooden foundation as contrasted with a concrete foundation, with a paving substance of wood or otherwise, with the object of deadening wheel and rail noises? A wooden sleeper-borne flexible track is certainly superior to the ordinary concrete bed from the point of view of quiet running. I would recommend any tramwayman who has not had experience of open wooden sleeper track to observe the immediate silencing of the tramcar when it leaves the hard concrete foundation for the sleeper construction on a private right of way.

On the other hand, with the obligations of the Tramways Act of 1870 as to the keeping of a perfect road surface, a rigid bed seems to be the only possible course. The legislature of this country imposed a heavy burden on tramways when Section 28 of the Tramways Act 1870, was enacted, or, what is more important, the literal and microscopical interpretation of the section by the Courts. In effect it means that the operators of a tramway, whilst having a statutory right to lay and use a steel rail in the public highway, must maintain the surface of that highway so that vehicles using the same should not in the least degree be prejudiced, even though the owners of such vehicles make no attempt to adapt the wheels to the new conditions, and the result has been the adoption of a hard, non-flexible and noisy track.

I am not sufficiently acquainted with the tramway law of other countries to say whether these conditions are altogether peculiar to this country, but I can say from observations in the United States that any attempt to achieve the impossible, i.e., introduce a light railway on the highway without impairing the surface, is not undertaken.

Design of Vehicle.

Regarding the vehicle, what attention has been given to the elimination of unsprung weight? For example, the wheels, axles, axle-boxes and half the weight of the motors represent a dead weight of 4,700 lb. on an ordinary 4-wheel 50-passenger car, and this unsprung weight is hammering on a rigid base in some cases at a speed of 20 miles per hour or more. No wonder that great damage is done to joints, points and crossings, accompanied by a terrific banging and clanging, which is at times a feature of the progress of a tramway car.

Is not this phase of the subject worthy of the serious consideration of tramway engineers? Could not a great proportion of this unsprung weight be converted to sprung weight? In connection with this, I would invite the attention of tramway engineers to the achievement of the automobile engineers, who have managed to cut down unsprung weight to a very small amount. How far could the present weight of axle and wheel necessary for the strain which the vehicle has to carry be reduced if some of the modern high tensile steels or other metals were employed, and a really scientifically designed wheel and axle adopted? How far is it necessary to carry more than half the weight of the motor with heavy gears on the car axle, and how far would it be feasible to carry the motor as sprung weight driving the car axle by some other means than a spur gear, with the consequent abandonment of the noisy and heavy spur gears?

This also opens up the possibility of higher speed motors (in consequence of higher gear ratios), which means lighter machines, and it should also mean

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cheaper machines to manufacture. Some progress has certainly been made during recent years in the direction of lighter motors, but we are not yet near the limit of possibilities. A well-known firm of motor omnibus builders are to-day employing an electric motor on their vehicles of a total weight of under 25 lb. per H.P. output, whereas the lightest tramway motor I know weighs about 70 lb. per H.P. output.

Designs of a motor as low as 20 lb. per H.P. output have recently been considered by my companies. This question of weight is extremely important from almost every point of view, and I feel confident that satisfactory results would be achieved if the problem was tackled in a scientific and thorough manner.

How far is it possible to introduce some non-conductor of sound and vibration between the tyre and the wheel centre or between the wheel centre and the axle? Difficulties are sure to be encountered, but if by some means we could isolate the short vibrations (noise) inseparable from the running of a steel wheel on a grit-covered steel rail we should kill two birds with one stone. Noise would be largely eliminated, and the premature destruction of many parts of the equipment by short wave vibration would be obviated, with a consequent reduction of the repair account, which is of paramount importance.

It is interesting to note in connection with the above that the first electric cars that were run in this country, viz., on the Blackpool Electric Tramways, opened in 1885, to which system I had some attachment as a boy, the motors were attached to the car body, the drive to the axle being by means of a double-reduction spur gear and an endless chain, and whilst this design had its crudities and was by no means ideal, I can say that the cars certainly ran very much sweeter, apart from the spur gear, than most of the cars of to-day; in fact, with a well-meshed spur mounted on the body the car was nearly noiseless.

Speed.

There is, of course, a limit to maximum speed in the public highway, beyond which it is not safe, but that maximum in its turn is governed by the time taken to bring the car to a standstill without unduly straining the equipment or the passengers in the process. I need not elaborate this point.

Deceleration.

The whole question turns on the employment of power brakes as contrasted with our present very unmechanical hand brake, first used, I believe, on Roman chariots. A deceleration of from 4 to 6 feet per second per second is a practicable proposition, and a rate at which cars could be brought to a standstill in a very short distance without inconvenience to passengers. This, together with better acceleration, would give an improved return to the undertakings, better service to the public, and lower working costs on account of a higher average speed. This question of average speed has never, in my view, had the attention it well deserves. An average speed of 7 to 7½ miles per hour is quite common, but it is in reality a poor performance for a vehicle with an almost unlimited amount of power at its disposal. This is a matter that has had some attention on the undertakings in London, and it might interest the members to know that the M.E.T. Tramways, for example, has an average speed, including all lay-over time, of 9·19 miles per hour, with consequent beneficial effects on costs and usefulness of service, but I think even that figure could be improved with newer equipments without increasing the maximum speed.

Acceleration.

The present acceleration of a tramcar is admittedly not inseparable from jerks. A steady high rate acceleration is very desirable, providing it is steady, but the present method of series parallel control does not lend itself to this desirable feature. I am not sure that we have not overrated the advantages of the series parallel control, and I would suggest that the subject of shunt motors with an even acceleration capable of running at any economical speed up to the maximum is worthy of consideration, with the possibilities of regeneration of current. Regenerative control was, in my view, just a little ahead of time. I had some very interesting results from experiments with Mr. Raworth's system some years ago. From the operation side the system was successful and practical in every way. The net current consumption of the cars fitted with this control was from 25 to 30 per cent. less than the ordinary equipments, but the motors would not stand up to the continuous work, and consequently they became overheated. Since then, as previously stated, motor design has improved, and what was impossible in, say, the year 1908, may be quite feasible to-day, with ventilated and inter-pole motors.

Again, it is interesting to note that the motors of the Blackpool Electric Tramways were shunt motors, and were quite unsuccessful, because little or nothing was known then about commutation poles or ventilated motors. These motors were quite impossible with a brass brush fixed to a steel plate on the commutator. Later they were converted to series motors with carbon brushes, and the author claims, with due modesty, to have introduced carbon brushes to motors for the first time, so far as he knows, on the Blackpool Tramways about the year 1888. Shunt motors were then therefore a failure, but they have so many advantages in certain directions that the subject is certainly worthy of consideration in the light of present knowledge.

Allied to this subject of speed control, I must mention a recent development of considerable value, viz., the use of contactors in the place of direct control of current from the platform. The present "box of tricks" on the car platform has continued too long a feature of every tramcar, and I welcome the efforts of certain eminent manufacturers to get rid of complications and substitute simplicity. Field shunting for control again comes well into view in consequence of commutation improvement, and the combination of all these new ideas should result in greatly improved and more economical service.

Collector Gear.

The present trolley pole, so common throughout this country, has always appeared to me to be about the most unmechanical and absurd piece of mechanism it is possible to imagine, but its present form is exactly what it was when, as a youth on the South Staffordshire Tramways, I had, with others, the honour of assisting Mr. Alfred Dickinson in the design of a swivel trolley head. Recently some slight advance has been made in the adoption of sliding heads instead of wheels, and whilst I am aware that this is a subject on which a special committee of the Association is reporting, and on which much diversity of opinion exists, I append a summary of reports of the various departments on

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the results of experiments carried out on the lines of one of our companies, which may be of interest—

SUMMARY OF REPORTS ON EXPERIMENTS WITH SLIDING TROLLEY HEAD ON THE METROPOLITAN ELECTRIC TRAMWAYS.

"The Traffic Department report that the sliding head has certain advantages over the trolley wheel from the running point of view, as it dewires less frequently, but in the event of dewirement it is not so readily replaced on the wire as the wheel.

"The Rolling Stock Department state that the skid has an advantage over the trolley wheel from the upkeep point of view, as not only has the cast-iron skid a considerably longer life than the wheel, but the maintenance of its parts is much less, and therefore it does not need the same attention.

"The Claims Department report that during the period of the tests, from December, 1921, to April, 1922, inclusive, the average number of dewirements was as under—

No. of dewirements per 10,000 miles' run—

Cars fitted with skids	1·49
Cars fitted with wheels	2·35

Further, the sliding head, owing to its lightness and the fact that it is not liable to foul the overhead equipment on dewirement, does not result in the same amount of damage as the wheel.

"On the other hand, the Overhead Department report that the wear and tear of the trolley wire with this type of head is about double that of the trolley wheel, but they have hopes of being able to reduce this by the adoption of more suitable material, or means for lubricating the wire."

Nothing exceptional in the way of improvement is here shown, but I do believe that if we could get the right type of designer and some insistent demand from tramway managers for better collector gear something would soon appear.

CAR BODIES.

Dealing with the carriage work of the car, I think much could be learned by studying the latest methods of body construction employed by motor omnibus builders. The body, like the rest of the equipment, should be scientifically designed, the main object being to cut down weight. The rule of thumb method of putting in heavy steel girders wherever some weakness has been detected might with advantage be reconsidered, and possibly something could be designed which would less resemble a box on wheels and embodying features which would make for popularity, and, in the long run, profit.

The design of a car body is very largely governed by the system of fare collection adopted, and I believe that this question needs the close consideration of tramway operators. There is undoubtedly a great leakage in revenue due to either non-payment or insufficient payment of fare, and under present conditions, where a conductor is acting not only as fare collector but as a general porter and attendant, doing his work often under very difficult circumstances, to say nothing of the want of incentive to get every fare, and the proper fare, considerable inefficiency prevails.

"Pay as you enter" or "pay as you leave" is, as is well known, almost standard practice in America, and the reasons why this system has not become common in this country are fairly well known. The critic will say that "pay as you enter" has been tried in this country and found a failure, owing to the zone fare system as contrasted with the flat fare system and the coinage and change difficulty. There is a great deal of truth in this, but can it be said that everything has been done to make "pay as you enter" possible?

In connection with the development of the one-man car on the London United Tramways, we have of necessity had to give close attention to the possibility of the fare transactions taking place on the platform, and have called to our aid several pieces of fare-collecting and ticket-issuing machinery which it has occurred to me might be of interest to the members of this Congress. I do not suggest that the exhibits before you of the Shanklin ticket-issuing machine or the coin-changing machine and the fare-box represent the last word in efficiency, but I do submit that the use of machinery considerably simplifies the fare collection problem. I do know that I have every experienced tramway manager with me when I suggest that if tramway undertakings were successful in getting the correct fare from every passenger the revenue of our undertakings would be beneficially and appreciably improved.

GENERAL.

The foregoing remarks about tramcar design generally are, I am afraid, somewhat in the nature of desultory observations, and more critical than constructive. My object will have been achieved if those who are responsible for producing new ideas will note the trend of desirable evolution, and appreciate the fact that tramways will only become obsolete when new designs for tramcars have become impossible. I cannot but feel that if the tramway industry had had the benefit of the almost Herculean efforts of the automobile engineer during the last ten years we should have been running to-day a much more up-to-date type of vehicle and with considerably better results.

It is somewhat lamentable, but none the less true, that what we require to-day was in reality invented many years ago, was tried and abandoned, generally because the inventors were a little ahead of their day, and if one might discreetly express an opinion the tramway manager is prone to lose heart in a new thing if immediate success is not attained. New ideas have generally got to go through their teething period, and early designs are generally crude. If, however, we would only condemn those ideas that are fundamentally wrong and struggle with those that are only wrong in some detail, I believe great progress would result.

The one-man car, which is so popular in the States, was, I believe, first tried in this country and abandoned. Regenerative control was tried here, but did not flourish, and so it might be said of many other new ideas not only affecting the tramway industry. The ideals of the early inventor are generally ahead of immediate practicability, but it is often worth while to review some past failures and hopeful attempts in the light of new conditions.

RAILLESS TRACTION AT LEEDS.

RESULTS OF THE PAST YEAR'S WORKING.

The following information relating to the railless traction installation of Leeds City Tramways is extracted from the annual report for the year ended March 31, 1922. The length of route now open amounts to 8 miles, 5 furlongs, and there are 10 cars in stock. During the year 206,758 miles were run, and 1,033,507 passengers were carried, averaging five per car-mile. The receipts amounted to £13,344, or an average of 15·49d. per car-mile. The working expenses were £11,937, an average per car-mile of 13·856d. The working expenses per passenger were 2·772d., and the ratio of working expenses to receipts 89·45 per cent.

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BOURNEMOUTH CORPORATION TRAMWAYS.*

By I. BULFIN, B.A., A.M.Inst.C.E., M.I.M.E., M.I.E.E.
(*General Manager.*)

In giving an account of the Bournemouth Corporation Tramways it is as well to start with the fact that the Bournemouth Corporation never wanted tramways in the borough. They opposed all applications that were formulated and ultimately tramways were forced upon them. This fact will explain some of the many difficulties that were experienced in Bournemouth.

The British Electric Traction Company in the year 1899 obtained their Light Railway Order for the construction of 3¾ miles of railway in the Poole area, i.e., from the County Gates, Bournemouth boundary, in a western direction to Poole station and opened this line for traffic in 1901. In the year 1900 the same company promoted a Tramways Act (Christchurch and Bournemouth Tramways Act, 1900) for a tramway connecting Bournemouth and Christchurch in an easterly direction. This latter Act included the tramway from the Hotel Metropole to Pokesdown Station in the Bournemouth area. The Bournemouth Corporation, in view of the B.E.T. Co. holding the light railways on the western side and their endeavour to obtain a tramway concession on the eastern side and partly in their borough, determined to apply to Parliament (as a blocking measure) for a Tramways Bill for their own area, and promoted in the same year the Bournemouth Corporation Tramways Order 1900. Parliament granted powers to the Bournemouth Corporation to construct the lines in their own area, and the line Metropole to Pokesdown in the B.E.T Co's. Act was held in abeyance subject to the Bournemouth Corporation constructing the line within two years. The Bournemouth Bill was only a blocking measure and the scheme was for a single line and passing places on the whole of the main route. In view of the fact that if the tramways were not constructed within two years their powers lapsed and a company had powers to run tramcars in the Bournemouth area, it became necessary to reconsider the whole scheme and to arrange for a double line right through. This necessitated the widening of roads, compulsory powers for acquiring lands and the preparation of plans and contracts for a large system, including depots, generating station, etc. The delays occasioned by these alterations and in obtaining the necessary powers resulted in the two years expiring before substantial progress was made, with the result that in 1902 the B.E.T. Co. issued an injunction against the Bournemouth Corporation constructing these lines as their powers had lapsed, and by an order of the Court of Appeal, dated July 15, 1902, this injunction was upheld. In order to retain the tramways in their own area it became necessary to buy out the B.E.T. Co., both on the Poole and Christchurch sides. The case went to arbitration and a price was fixed and agreed. Owing, however, to trouble with the Dorset County Council, it became necessary for the Poole Corporation to buy the Poole line and they leased these lines to Bournemouth for a period of 30 years, the Bournemouth Corporation agreeing to pay as rent a sufficient sum per annum to pay interest and sinking fund on the purchase price and at the expiration of the 30 years' lease the Poole Light Railway would become the property of the Poole Corporation free of all costs.

The Poole Corporation, in leasing the Light Railways to Bournemouth, imposed a large number of conditions which were embodied in the Bournemouth Corporation Tramways Act 1903 and which became later a source of continual trouble and friction, one condition being that the Bournemouth Corporation should not charge higher fares in Poole area than the B.E.T. Co. were charging in 1903. This condition placed Bournemouth Corporation in the position of not being able to make use of the Tramways (Increase of Charges) Act until March, 1921, when the Bournemouth Corporation undertook to take over the whole of the outstanding loan charges on the Poole undertaking. The amended Bournemouth scheme for tramways was for a double line of tramways through the whole of the main route run on the trolley system, but in the centre of the town they decided to instal the conduit system (being equal to a length of some 2¾ miles of single track). The system was side slot running to centre slot at all special work, identical in every way with the centre slot London County Council system, but laid and run prior to the London County Council system.

PERMANENT WAY.

The conduit system was run for some ten years when, owing to heavy wear of rails and conductor tees, it became necessary to relay this portion of the line. In going into the cost of renewal either as a conduit system or changing over to the trolley system, it was decided after very careful consideration of all the points in question to abandon the conduit and run the entire undertaking on the trolley principle. The main lines in Bournemouth were opened to traffic in 1902 and the side routes in 1903. The tramway to Christchurch was constructed by the Bournemouth Corporation and opened for traffic in 1905, and in the construction of this line it became necessary to buy out the Toll Bridge Company at Tuckton Bridge over the River Stour (a narrow wooden bridge on iron piles some 380 feet long). This bridge was pulled down and a ferro-concrete bridge erected—one of the first and longest ferro-concrete bridges in England carrying a double line of tramways. In 1906 the Lower Parkstone line was laid and opened for traffic. At the present time the route mileage of the system is some 23 and the length of single track over 33 miles and runs in three boroughs —Poole, Bournemouth, and Christchurch.

The permanent way laid prior to 1912 had fish-plated anchored joints and the average cost per mile of single track with wood block paving was between £5,000 and £6,000. Between 1912 and 1915 some 12 miles were relaid with Thermit joints and transverse sleeper construction, the sleepers consisting of the old rails cut into lengths of 5 ft. 4 in. and clipped to the new rails every 5 ft. apart, the average cost per mile of single track with wood block paving being between £6,000 and £7,000. In 1920, 1921 and 1922 some 12 miles of single line were laid with transverse sleeper construction every 5 ft. apart and Thermit joints and B.R.C. reinforcement, the cost per mile of single track with wood block paving being between £18,000 and £19,000. Corrugation has been very prevalent all over the system and up to 1919 the only method of dealing with this was by means of a track grinder. In 1918 about seven miles of track were treated by the Sorbitic in-situ process and the result has been most satisfactory in every way. I unquestionably

* A Paper to be read at the Congress of the Tramways and Light Railways Association.

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hold that this is the only method I have found to prevent a recurrence of this evil and when the financial position is more satisfactory I intend treating all relaid portions of the track in the same manner.

POWER SUPPLY AND ROLLING STOCK.

The current for the tramways in the Bournemouth area is supplied from the Corporation station. The plant consists of four Lancashire boilers with mechanical stokers, four Belliss and Morcom triple expansion engines 500 to 600 H.P. each, coupled direct to four B.T.H. multipolar dynamos. The condensing plant was supplied by Messrs. Belliss and Morcom. There is sufficient room for the equipment of a further 50 per cent. increase of plant in the station. The whole of the water supply is obtained from an artesian bore 300 ft. deep and the water is raised by compressed air, steam and electricity. The current in the Poole area and the Christchurch section is supplied by the Bournemouth and Poole Electric Supply Company, Limited, owing to prior contracts entered into by the B.E.T. Co., which the Bournemouth Corporation had to accept when taking over the tramways.

There are four depots and car sheds situated in different parts of the sytem, the main depot and repair shops being at Southcote Road. The new depot at Moordown is an example of the use of old rails in building construction. There are six tramway shelters installed on the system. The rolling stock consists of 112 cars—67 bogie and 45 single trucks. The equipments are British Westinghouse and British Thomson-Houston. Magnetic track and rheostat brakes are installed on all cars. The brakes on the Bournemouth Corporation Tramways are peculiar to the system and were designed and supplied by the British Westinghouse Company. These brakes are combined magnetic and track, and can be applied either electrically or by hand. They are very complicated and maintenance and upkeep is very heavy. The maximum gradient is 1 in 12 and the sharpest curve some 40 ft. The gauge is 3 ft. 6 in. throughout the system. The gauge gradients and curves preclude the possibility of the use of top-covered cars.

It may be of interest to members to know that in Bournemouth the capital charges work out at over 9d. per car-mile and that the financial position of the undertaking is dependent entirely on visitors. A surplus is made from April to September in each year sufficient to meet the loss of running between October and March and in some cases to leave a surplus balance at the end of the year. As instancing the growth of tramway traffic, particulars of yearly returns of 1903 to date are given hereunder—

One of the New Cars of the Bournemouth Corporation Tramways.

Year	Passengers Carried	Traffic Revenue	Car Miles	Working Expenses	Surplus
		£		£	£
1903	3,073,450	17,637	324,650	8,720	4,826
1904	9,363,985	52,445	1,002,163	29,810	4,807
1905	10,058,288	55,276	1,121,623	33,500	7,918
1906	12,617,927	73,094	1,494,261	44,062	6,416
1907	13,503,610	83,663	1,765,098	53,598	806
1908	13,991,328	86,024	1,766,068	53,163	385 Def.
1909	13,735,267	82,017	1,748,515	55,680	5,416 Def.
1910	14,010,647	85,684	1,794,997	55,901	1,755 Def.
1911	14,703,679	89,569	1,784,249	57,717	130 Def.
1912	15,121,935	91,421	1,844,507	54,841	3,379
1913	15,750,576	95,694	1,822,054	52,293	10,478
1914	17,182,844	104,353	1,962,352	59,011	15,070
1915	16,967,210	101,882	1,815,632	55,066	9,083
1916	17,577,580	107,575	1,670,702	51,794	14,057
1917	17,947,463	113,518	1,634,640	53,711	16,275
1918	20,454,597	131,673	1,657,852	62,650	26,329
1919	20,769,507	148,449	1,374,411	73,980	29,599
1920	27,080,255	188,739	1,684,874	114,271	32,729
1921	27,403,621	195,468	1,857,576	152,027	17,006 Def.
1922	24,271,692	206,257	1,684,513	146,161	98

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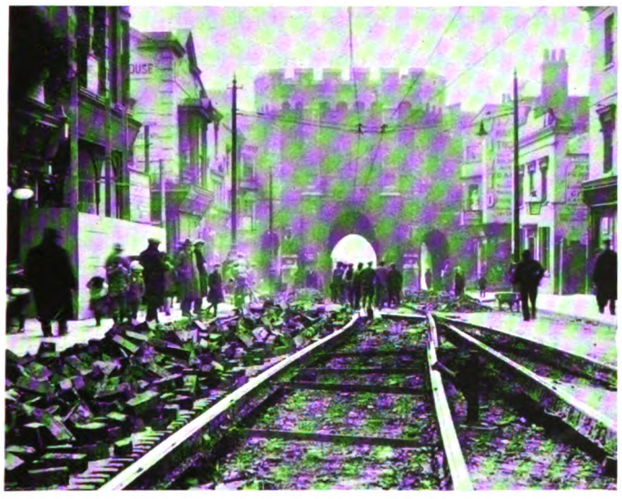
The Bournemouth Corporation Tramways are worked under the following Acts—Bournemouth 1900, Christchurch and Bournemouth 1900, Bournemouth Corporation Act 1901, Bournemouth Corporation Act 1903, Bournemouth Corporation Act 1904.

STATISTICAL INFORMATION FOR THE FINANCIAL YEAR ENDED MARCH 31, 1922.

Capital Expenditure—	
Bournemouth and Christchurch Tramways ...	£705,000
Poole Tramways, leased to Bournemouth Corporation	£130,330
Track mileage	33
Population served	140,000
Traffic revenue	£206,257
Total revenue	£207,356
Working expenses	£146,161
Gross balance	£61,195
Net revenue, additions to gross balance	£3,758
Total gross balance	£64,953
Interest on capital and sinking fund	£49,586
Rent of leased lines	£10,961
Other net revenue charges	£4,248
Total net revenue charges	£64,795
Net profit, tramways	£158
Net loss, motor omnibuses	£60
Net profit on undertaking	£98
Car-miles	1,684,513
Passengers carried	24,271,692
Units per car-mile	2·04
Percentage of working expenses to receipts	70·48
Average traffic revenue per car-mile	29·38d.
Average traffic revenue per mile of track...	£6,284
Average fare per passenger	2·03d.
Number of cars in stock	112

MANGANESE RAIL WELDING AT SOUTHAMPTON.

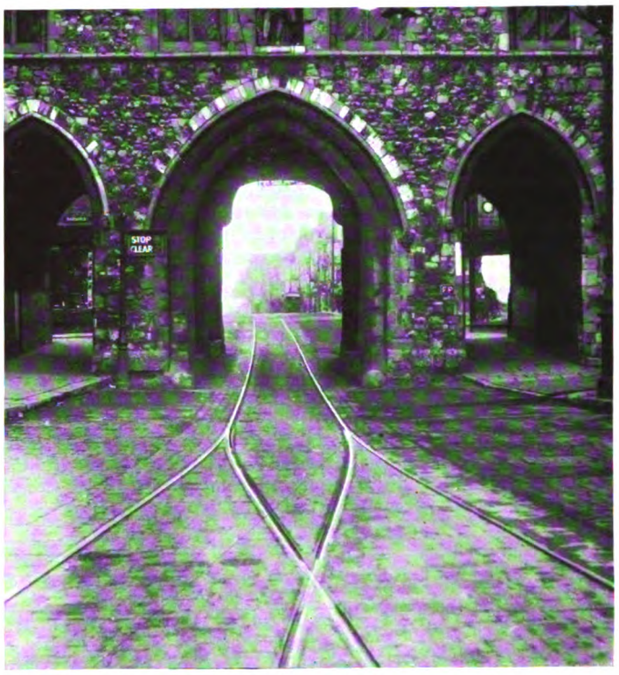
An interesting example of electric arc welding was recently carried out at Southampton, under the supervision of the general manager and engineer of the Corporation tramways, Mr. James Dobson. Visitors to the town are acquainted with the old Bargate which exists in the centre, and which is illustrated in one of the accompanying photographs. The Bar is



Turnout Under Construction at the Bar Gate.

of great historical interest, but its builders did not foresee that one day it would have to accommodate itself to the requirements of an electric tramway service. Not only is it so low that cars have to be specially built to pass underneath, but it is only wide enough to allow for a single track through its portal. The service is a busy one, cars passing in each direction on an average of one every 30 seconds during rush hours, in addition to heavy ordinary road traffic. It is therefore easy to understand that ordinary rails do not have very long life; in fact they have had to be renewed every seven or eight years in consequence, at very heavy cost, and with great inconvenience to the town generally.

With the idea of avoiding this periodical trouble, it was recently decided to re-lay the whole length of the



New Turnout and Track at the Bar Gate.

single route under the Bar, together with turn-outs and points at each end, in manganese steel. This work has actually been accomplished, and constitutes perhaps the longest length of solid manganese trackwork in the country. The whole of the rails have been supplied by Messrs. Edgar Allen and Company Limited, of Sheffield. It is expected that they will last for from twenty to twenty-five years, and in consequence should prove considerably cheaper in the long run, apart from the fact that their use obviates recurring inconvenience to the public.

Perhaps the most interesting portion of this work is the fact that electric arc welding has been solely used in the building up and attachment of the joints. The method adopted has been the use of high carbon steel fishplates of ordinary form. These are secured by bolts in the usual manner, together with a seam of electric arc welding along the top and bottom edges. Underneath the joint there is a sole plate of the same material, which is also welded solid in position. It was at first thought doubtful whether the high carbon steel plates could be effectively welded to the manganese rails. However, after consultation with the Equipment and Engineering Company, it was decided to use their "K" grade manganese metallic electrodes. The effect was found to be entirely satisfactory, and it is interesting to know that although the two metals were of different melting points, the weld took effective hold, and after preliminary trials was found to be perfect.

The execution of this difficult work reflects great credit upon the welding department of the Southampton tramways and upon the general manager.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JUNE 15, 1922.

The London Transport Congress.

The London Congress of the Institute of Transport may be regarded as a notable step in the growth of this young but energetic body. The amount of interest that it aroused in transport circles in London, throughout the provinces, and even abroad was indicated by the fact that nearly 700 members, graduates and students attended, representing almost every form of locomotion—railway, tramway, omnibus, commercial motor vehicle, water-borne craft, and even aircraft. The Institute of Transport, indeed, embraces in its scope a wider field than any kindred organisation, but in spite of its diversified interests, excellent arrangements were made to meet the needs of practically every individual member. The nine papers that were read, ranging from the design of commercial motors to wireless telegraphy as an aid to transport, expressed the views of men who may correctly be described as experts on their respective subjects. Not only were these meetings eagerly attended, but the lengthy discussions which followed the papers were often as illuminating and interesting as the original contributions themselves. So anxious were some of the lecturers to hear what their audience would have to say that they saved time by delivering a prepared summary of their papers (which, of course, were available in printed form), or extemporised a summary as they went along. As for road transport, it was made clear by several highway engineers that anxiety for the future of our roads is acute. Many theories were advanced as to how the greatest wear and surface corrugations are brought about, and how they can best be counteracted. It was only natural that a corresponding interest should be displayed in the form that future types of motor vehicles will take, the possibilities of pneumatic tyres, and the prospect of six or more wheels being utilised to distribute road friction. One matter on which there was decided unanimity was that the present basis of motor vehicle taxation is unsound and unfair. In view of the fact that at least one member of the Government Committee charged with this matter took a leading part in the proceedings, it is not unlikely that some revision may be effected. The many visits of inspection which the members of the Congress were privileged to make to the transport systems and workshops of various undertakings in and about London proved of especial interest, and were most efficiently organised. The opportunity thus afforded men from widely distant parts of the country for coming together and seeing the inner working of leading transport concerns, and discussing their own experiences, cannot but have been helpful, particularly to the younger members, of whom there were many. The delegates from overseas, who came from Shanghai, South Africa, France, Holland and Vienna, were also impressed with what they saw, and will doubtless have much of interest to relate to their people at home about British transport systems and the hospitality of British transport men.

Abuse of Competition.

Although a reasonable amount of competition in transport may be an advantage to the public, no one will deny that there are circumstances in existence which justify the assertion that a decided misuse is being made of competitive means of transport with tramways. Such a condition arises when members of a public authority are not averse

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from encouraging any sort of applicants for hackney carriage licences to enter into rivalry with a tramway undertaking operated by a company. This procedure is the more reprehensible when one bears in mind that competition by reputable vehicle owners is already in existence. In looking for a possible explanation for extending competition until it becomes an abuse, the cause is soon discovered. It is that in a few years' time the tramway undertaking may be taken over by the municipality if advantage is taken of an impending option to acquire it. To a certain class of Councillor such an opportunity is nowadays too good to be lost. His motive is all too clear. He may imagine that a wholesale depreciation of a company's tramways, aided by the present economic difficulties, may lead to an opening for acquiring the enterprise at scrap value. A word of warning may be uttered to individuals who favour Bolshevist methods being applied to legally constituted bodies carrying on tramways under powers derived from the Legislature. What would be the position of the local authority if the astute business men, who by private enterprise meet the wants of the travelling public, decide to abandon an undertaking? Would not the Town Council be faced by the task of removing the rails at their own expense and reinstating the roadway? Certain it is that they would lose a substantial sum paid in rates on the track, together with the company's outlay for maintaining a considerable area of the roadway. And what is there to prevent the late tramway undertakers from instituting omnibus services, thus compelling a local authority to incur great expense in putting the roads into a condition to bear the extra traffic? There is every encouragement for such a change of traction under the provisions of the Roads Act of 1921. That Act practically takes from provincial authorities the old power of control of their roads. Under that Act any refusal of a Watch Committee to issue licences can be overridden by the Ministry of Transport. That body, it must be confessed, entered upon the task of bringing the whole transport of the nation under their ægis without the assistance of anyone familiar with road traction. Tramway authorities have since found that the results of the Act are proving intolerable, and it is not surprising that their representations, after receiving one rebuff have, in conjunction with other interests, borne fruit. The result is seen in the formation by the Minister of Transport of a committee to consider the use, construction, and regulation of all forms of road passenger vehicles except tramcars and railless trolley cars. Unnecessary competition might well form one subject for consideration.

A New Plea for Tramcar Vestibules.

For some years cars have been operated in the midland and northern areas of the kingdom with the platforms either wholly or partly enclosed by glass partitions. New single-deck cars show that it has become standard practice for platforms to be wholly enclosed. With the introduction of the one-man car on a light traffic line between Kingston and Tolworth by the London United Tramways Company, the wholly enclosed platform has made its first appearance in the metropolitan area. In this case the complete vestibule has to do with the working of the payment-on-entry system and the control of passengers alighting. This dual method of economy will, it is hoped, effect a further saving by eliminating the accidents that arise on the open platform. Hitherto the demand for vestibules has chiefly come from employees on exposed routes in the north. Whether the London suburban innovation will lead to developments in southern England and elsewhere remains to be seen. On climatic grounds there is little justification for vestibules in a considerable portion of the country, but there is a new reason that may possibly be advanced—one that has already been put forward in the midland area. There the managers' and employees' representatives, meeting in the Area Industrial Council, have recommended all the undertakings within the district to adopt the vestibule for all cars. In support of the request it is urged that the dust now thrown up from the roads by motor vehicles affects the eyes and throats of the motormen. This nuisance, we should imagine, is mainly confined to the waterbound macadam roads, for some years must yet elapse before tar and bitumen preparations are universally used on roads not paved with wood or setts. The objection to the

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dust created by motor traffic is certainly one of great importance, both in view of the large increase of such machines and of the possibility that the entry of dust into a motorman's eye may lead to an accident. The midland area does not stand alone as regards the effect on the eyes, for drivers on the London County Council cars may now be seen wearing goggles in order to keep free of dust and grit. If this is the case where the roads are well paved and scavenged, it requires but little imagination to picture the position elsewhere. Possibly the trouble could be overcome by the invention of combined goggles, nose and mouth respirator.

LIVERPOOL PIERHEAD TRAMWAY TERMINUS.

In the illustrated description of the Pierhead terminus of the Liverpool Corporation Tramways, which appeared in our issue of May 18, there was an important omission that we are glad to rectify. It should have been stated that the scheme was originally conceived by the former general manager, Mr. Charles W. Mallins. For years the undertaking had to contend with inadequate facilities at the Pierhead, and from time to time plans had been presented for the purpose of securing an improvement. None obtained the approval of the Tramways Committee until Mr. Mallins developed his scheme for constructing the three large balloons with extensive stand-by accommodation. Mr. Mallins' plan was the result of long study of the problem, and if industrial difficulties had not arisen after the war the work would have been undertaken before his resignation. Now that it has been completed the rearranged and extended lay-out forms a fitting conclusion to the valuable work that Mr. Mallins accomplished for the Liverpool tramway undertaking. It is a matter for congratulation that the carrying out of the scheme was entrusted to a city engineer of the eminence of Mr. J. A. Brodie, whose interest in traffic arrangements is well known.

TRAMCAR CONDUCTOR'S DUTY.

IMPORTANT APPEAL TO THE HOUSE OF LORDS.

A case of much interest to tramway managements was decided in the Appeal Court of the House of Lords on May 26. Lord Haldane, Lord Cave, Lord Finlay, Lord Dunedin, and Lord Wrenbury heard the case. The appellant, John Percy, a printing machine hand, of Glasgow, originally brought the action against the respondents, the Corporation of Glasgow, for damages for false imprisonment, or, as it is called in Scotland, "wrongous detention," arising out of an incident in a tramcar. The Lord Ordinary, before whom the action came in the Court of Session, held that the case, as averred by Mr. Percy, was relevent, and he approved of an issue for the trial of a cause. The First Division of the Court of Session recalled the interlocutor of the Lord Ordinary, and dismissed the action. Against this judgment Mr. Percy now appealed to the House of Lords.

Appellant's case was that in July, 1920, when a passenger on a Glasgow Corporation tramcar, he tendered a penny, said to be slightly marked but not defaced, in payment of fare. The conductor refused to accept the coin, and demanded another, which the man refused to give. The conductor then called a tramway inspector, who repeated the demand for another penny, with the same result; and on Percy insisting that the coin was good, the inspector and conductor called a police constable, and, as Percy alleged, gave him into custody on the charge of refusing to pay his fare, notwithstanding that he gave his name and address to those officials of the Corporation. Mr. Percy was then, he said, removed from the car by the constable and taken along the public street to the police station. There he was detained for about ten minutes, and then allowed to go on the undertaking to return for further procedure next morning. On the following day he attended at the Police Court, where he was informed that the matter was finished. No proceedings were instituted against him. In these circumstances Mr. Percy raised an action for damages against the Corporation, as being legally responsible for the wrong to which he alleged he was subject at the hands of their servants, claiming £500 and £100 expenses.

The Corporation contended that under their by-laws it was a condition precedent to the exercise by the tramway officer of the power of seizing and detaining a passenger that the name or address of the passenger should be unknown to the officer or servant, and on the showing of Mr. Percy himself, the conductor and inspector acted outside the scope of their employment and authority.

Lord Haldane, in giving judgment, said he was unable to agree with the First Division Court which dismissed the action on the question of relevancy simply. He was of opinion that in the circumstances alleged, the employees were agents "acting within the scope of their agency." He thought, therefore, that the pursuer had on this footing the right to have issues of fact, which appeared to have been relevantly stated, tried out. If that be true the interlocutor of the First Division should be recalled and that of the Lord Ordinary restored. So far as the appeal was concerned, the appellant, having sued *in forma pauperis*, was not entitled to more costs than were usually allowed in such cases. The other Lords gave judgment to the same effect, and the issue will therefore be re-tried.

LONDON UNDERGROUND EXTENSIONS COMMENCED.

A memorandum by Lord Ashfield with reference to the London Underground extensions to be carried out under Treasury guarantee with respect to the capital was circulated on May 26 to the London Members of Parliament. After referring to the original proposals which were declined by the Government in November last, Lord Ashfield gave a summary of the revised scheme with which it has been decided to proceed. This includes (*a*) the Edgware Extension Railway from Golders Green to Hendon and Edgware, a distance of 4¼ miles, with five stations, and (*b*) the connecting railways between Camden Town and Euston, which will enable through services to be worked from the northern branches of the Hampstead line over the City and South London Railway to the Bank and Clapham Common. Provision is also made for station improvements, such as the provision of escalators, and additions to the power plant at Lots Road power-station. The City and South London Company's tunnels will be enlarged and improved to conform with the standard of the other tube railways, and new rolling stock will be provided. Particulars were given of the Treasury guarantee, and the memorandum concluded with the statement that contracts have now been placed for a large part of the work, and operations would commence immediately. The whole of the plant equipment, with the one exception of certain parts of the escalators, will be manufactured in this country.

A beginning was made on June 12 with the work on the Golders Green to Edgware extension, when Lord Ashfield, many of his fellow directors, and several invited guests witnessed the turning of the first sod at Golders Green by Sir Philip Lloyd-Greame, M.P. for Hendon.

BIRMINGHAM TRAMWAYS WAR MEMORIAL.

The memorial erected by Birmingham Corporation tramway employees to their 236 comrades who fell in the war was unveiled on Sunday, May 28. The memorial is an imposing monument erected on the Tramway Stadium, King's Heath. It is 20 ft. high, and is enclosed in a formal garden fenced off from the playing field by a beech hedge. Special cars conveyed some 2,000 tramwaymen, their wives and families to the Stadium. Wearing their medals and ribbons, they formed up in companies, and, headed by the tramways band, marched to the site of the memorial. The procession included the Bishop of Birmingham (Dr. Russell Wakefield), the Lord Mayor (Alderman David Davis), the Town Clerk (Mr. F. H. C. Wiltshire), the chairman (Councillor F. Smith), and members of the Tramways Committee, the general manager (Mr. Alfred Baker), and the principal officers of the department.

Mr. Baker, speaking prior to the unveiling, said that on the outbreak of war no body of men answered to the call of King and country with greater enthusiasm than the Birmingham tramwaymen. In less than a month 600 men, or 20 per cent. of the total number of the employees of the department, voluntarily joined up. Throughout the course of the war the department supplied to the forces 1,800 men. The whole cost of the memorial had been contributed by the men themselves, without any outside assistance whatever, from the Corporation or the Tramways Committee. After the Lord Mayor had delivered a brief address, Lieutenant F. Clarke, M.M., one of the employees of the tramways who gained a commission during the war, unveiled the memorial, which was dedicated by the Bishop of Birmingham. All the cars and omnibuses in service in the city halted for two minutes during the ceremony. A photograph of the memorial we hope to reproduce in a subsequent issue.

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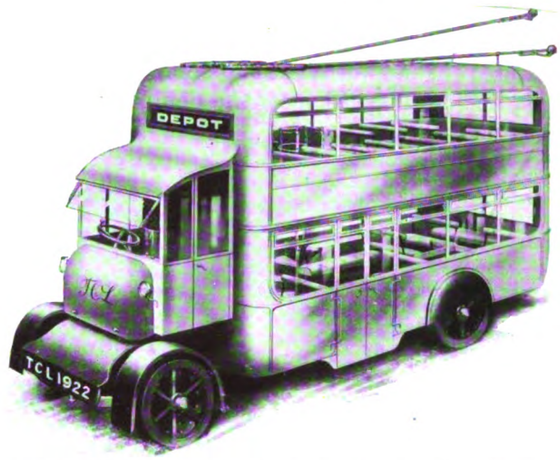
FRONT-DRIVE TRACKLESS CAR.

DOUBLE-DECK VEHICLE WITH CENTRE STAIRS.

The success which has attended the use of the "front-drive" trackless trolley vehicle, with double decks, by Leeds Corporation lends interest to a new type of car on this principle that has been manufactured by Trackless Cars, Limited, of Hepworth Chambers, Briggate, Leeds. An earlier type of front-drive trackless car which had been built for the Leeds City Tramways by the same firm was illustrated and described in our issue of December 15, 1921, but while that vehicle had seating accommodation for 59 passengers, the latest one accommodates 64, in addition to the driver. It is also characterised by a number of substantial improvements as compared with its forerunner.

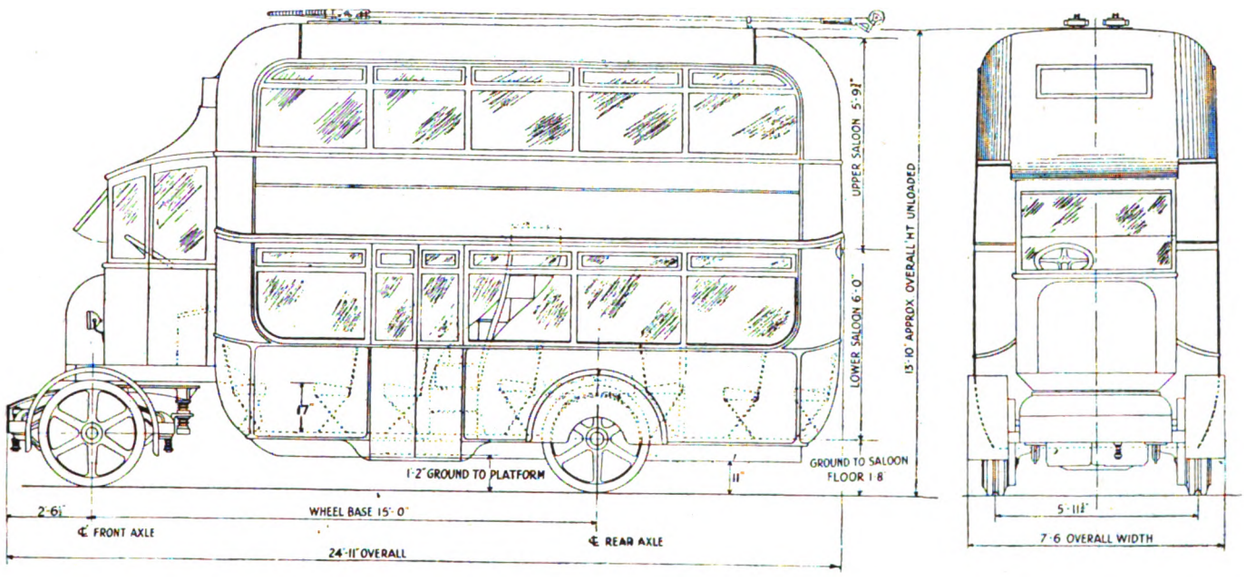
One of the principal advantages of the front-drive system is that owing to the concentration of the tractive mechanism at the forward end of the chassis a drop frame may be used, and this allows more head room in both saloons. The overall height of the vehicle is correspondingly reduced, and it is enabled to pass under low bridges—quite common in the north—from 14 ft. 6 in. upwards in height. The lowness of the centre of gravity also tends to reduce oscillation of the vehicle when in motion—a circumstance which naturally inspires confidence in the travelling public.

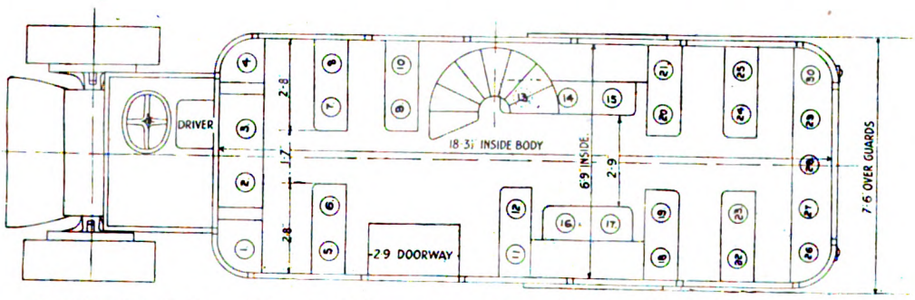
room in the lower saloon is 6 ft. and in the upper 5 ft. 9¾ in. The overall height from ground to the roof is 13 ft. 10 in. An entirely new feature is the easy-rising staircase which is installed in the middle of the



Double-deck Trackless Car with Centre Door and Staircase.

body. It passes from the off-side of the lower saloon to the deck above, and is thus totally enclosed. The entrance to the car is at the forward end of the saloon, through a doorway 2 ft. 9 in. wide. The height of the doorway platform from the ground is only 14 in.





Elevations and Plan of Lower Saloon of Trackless Car with Centre Door and Stairs.

The new vehicle, as shown in the accompanying illustrations, has seats in the lower saloon for 30 passengers, while the upper deck holds 34. The head-

Every provision for the comfort of passengers has been made in both saloons. All the seats have spring cushions, and the back rests are padded. Ample knee room is provided, and the ventilation is effected on thoroughly up-to-date lines so as to eliminate draughts.

The driving unit is on a fore-carriage, and the motors are carried fore and aft of the front axle, being supported at their outer ends by coil springs bearing on the fore-carriage frame. Each of the front road

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wheels is driven by one of the motors, the drive being direct through a pinion on the motor shaft and internal gear ring fixed in the wheels. The gears run constantly in oil. As mentioned in the previous article alluded to above, an important feature of the front-drive system is the ability to remove and replace the driving unit by merely undoing eight bolts attaching it to the main frame channel members and sliding out endways.

The principal dimensions of the double-deck vehicle are as follows—

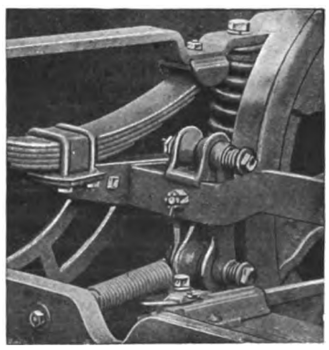
Length overall	24 ft. 11 in.
Wheel base	15 ft.
Height overall, (unloaded)	13 ft. 10 in.
Height, lower saloon	6 ft.
Height, upper saloon	5 ft. 9¾ in.
Width overall	7 ft. 6 in.
Width between wheel tyre centres ...	5 ft. 11¾ in.
Ground to saloon floor	1 ft. 8 in.
Clearance from ground	11 in.
Inside length of body	18 ft. 3½ in.

The time taken in withdrawing and replacing the unit is about two hours. Irreversible steering is provided, so that no obstacle in the path of the front wheels can deflect the line of motion of the vehicle.

Trackless Cars, Limited, have also turned out a single-deck front-drive railless trolley vehicle. This is very similar in dimensions (except, of course, in height) to the double-deck car, the seating capacity of the saloon being 32. The seats are arranged on the same principle, and the two extra ones take the place of the absent stairway. The overall height is 9 ft. 5 in., and the height of the saloon 7 ft. 6½ in. The doorway is similarly located to that in the double-deck vehicle. These railless cars have been manufactured under the Bishop and Chadwick patents, and for the foregoing particulars we are indebted to Mr. J. Wright, general manager of Trackless Cars, Limited.

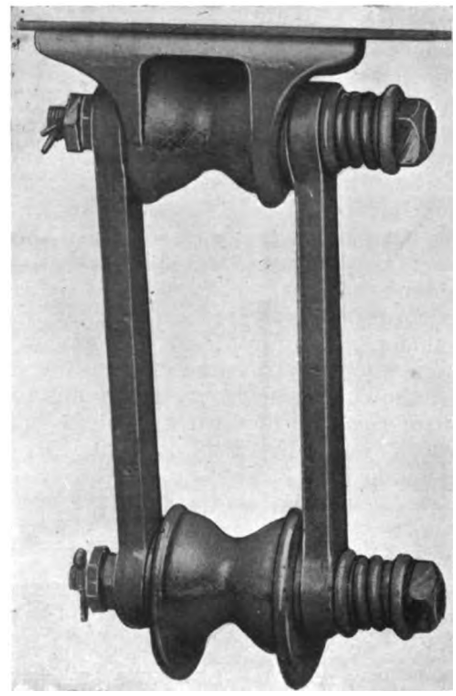
BRILL IMPROVED BRAKE HANGERS.

Half-ball brake hangers have been a standard fitment on Brill trucks for many years, and their success is undeniably due to the sound engineering principles upon which they are founded. Briefly, a pair of hanger forgings with half-ball ends fit snugly into half-ball sockets, and the whole is held in tension by a spring on a bolt, as shown in the accompanying illustrations. The upper and lower castings have hitherto been made of malleable iron. The improvement consists in making these of electric steel. Not only is this superior to malleable iron for this purpose, but the steel is further hardened by a dipping process. This produces a tough and durable surface in the half-ball sockets that offers considerable resistance to wear in this overworked portion of the truck equipment. The tensile strength of this electric steel is 70,000 lb. per square inch, compared with 40,000 per square inch for the malleable iron brackets and holders.



Brake Hanger in Position on 21E Truck.

Another feature of interest is that these electric steel castings can be produced in a few days. Three to four weeks is a good average for malleable iron. The physical elements in this electric steel are equally as marked, and, compared with the original malleable iron castings, indicate a superiority that in terms of durability and long life more than justify its selection. One of the many attributes of the half-ball hanger is its noiselessness in operation. It cannot chatter, as will be evident from the general design. Noisy trucks are a bane. Loose, ill-fitting links and pins of the common type on indifferent tracks create a large proportion of the din. The half-ball hanger has no nuts



Brill Improved Brake Hanger.

to require constant adjustment, as the spring on the bolt takes up automatically any gradual wear. This means that the ball and socket is always in contact under spring tension; therefore wet dust or grit cannot work in between the bearing faces.

The half-ball ends of the hanger forgings are milled, and the electric steel sockets are reamed, providing a perfect fit. The load and all the movement is upon these two finished surfaces, for the bolt which passes through the socket casting and the hanger ends, and on which the compression spring is placed, serves entirely as a compression member for the spring, and carries no other load and is never in shear. In fact, the hole in the socket casting through which the bolt passes is one-eighth inch larger than the diameter of the bolt. It is this feature which allows a slight torsional movement, and this makes the device self-adjustable for brakeshoe and wheel wear, as well as for any lateral motion of the wheels on curves. Vibration and jolting cannot disturb the relation of the members; moreover they cannot work or shake loose; the result is a noiseless glide to and fro. This hanger has a record of over four years' service without changes or renewals.

Cost of London Omnibus Operation.—An announcement has been made by the London General Omnibus Company to the effect that for every £100 taken in fares the company spend £90 in maintaining and working the services. "Only for a large fleet," the statement adds, "can such a narrow margin between earnings and expenses be safe and acceptable."

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THE INSTITUTE OF TRANSPORT CONGRESS.

SUCCESSFUL GATHERING IN LONDON, MAY 17TH—20TH.

The second annual congress of the Institute of Transport which was held in London from Wednesday, May 17, to Saturday, May 20, proved from every point of view a notable success. The event was naturally on a much larger scale than that of the first congress held at Manchester in January of last year, and it would have been difficult to conceive a more varied and interesting programme than that prepared for the delegates. Not only did members come from all parts of the British Isles, but there were several visitors from places abroad, including France, Holland, Vienna, South Africa and Shanghai. All were highly pleased with their reception and with the facilities which the congress afforded for inspecting centres of interest to transport men. The progress which the Institute is making as a body may be gauged from the rapid increase in membership during the three years of its life to something like 1,200. The credit for this encouraging development is largely due to the untiring efforts of the Institute's honorary secretary, Mr. H. E. Blain, C.B.E., who was chiefly responsible for the successful organisation of the congress.

The proceedings were inaugurated on Tuesday evening, May 16, by a reception at the Hotel Metropole, the headquarters of the congress, at which the president (Sir Henry P. Maybury, K.C.M.G., C.B.) welcomed the delegates and their ladies. The business meetings commenced the following morning at the Institution of Civil Engineers, Westminster, when the President of the Board of Trade (Mr. Stanley Baldwin) formally declared the congress open.

Sir HENRY MAYBURY said it was appropriate that the first congress of the Institute to be held in London should be opened by such a distinguished member of H.M. Government as the President of the Board of Trade.

Mr. BALDWIN pointed out that for a country like ours, cheap transport was a vital necessity, not only for the conveyance of foodstuffs, but for that of raw materials which were essential to preserve our export trade. Cheap transport was also essential for us to get these exports into the markets of the world, as a matter of a shilling or two in the cost of transport to remote countries might make all the difference between securing trade and losing it. There was no greater difficulty that we had to contend with at home to-day than the high cost of inland transport, and anything which could be done to remedy this should receive encouragement. It was only by the development of transport on broad and radical lines that we could enable our congested working population to live in decent surroundings and decent homes, yet at the same time continue to work at factories in the towns. In conclusion, Mr. Baldwin said he had much pleasure in declaring the congress open and wished the delegates every success in the work which lay before them.

On the motion of Sir H. P. MAYBURY, seconded by Sir SAM FAY, a vote of thanks was accorded the President of the Board of Trade.

Sir HENRY MAYBURY then cordially welcomed the visitors from abroad and said most of the British delegates present had the warmest recollections of the way in which they themselves were received when they had visited the great centres of the countries from which their visitors came. Alluding to the holding of the congress in London—" the turntable of the world "—this year, the president said the Council of the Institute of Transport were encouraged to come to this arrangement by the success of the congress at Manchester in 1921.

CONSTRUCTION AND MAINTENANCE OF HIGHWAYS.

Colonel C. H. BRESSEY, O.B.E., of the Roads Department, Ministry of Transport, read a paper on " The Design, Construction and Maintenance of Highways in Relation to the Development of Mechanically Propelled Vehicular Traffic." Mr. A. Dryland, county surveyor of Middlesex, presided. Colonel Bressey said a grave responsibility had been imposed upon the road engineer of to-day. In a time of unexampled change he had to give proof of unexampled adaptability. The immemorial road system which he inherited had to be transformed as rapidly and cheaply as possible to meet the demands of forms of transport bearing no resemblance to the traffic of thirty years ago. Utterly new standards of weight and speed were being established; the formulas and practice of the road engineer were undergoing a corresponding revision. Great assistance would be rendered to all engaged in the study of transport problems by the publication of more comprehensive and uniform road traffic statistics. During the upheaval of the past few years investigations of this character had necessarily been shelved in favour of more pressing duties, but it was much to be hoped that, before the year was out, it might be found possible to organise a general road traffic census throughout the United Kingdom, even if the investigation be limited to first-class roads.

In this ancient country, already thick set with tortuous thoroughfares, the road designer was usually faced with perplexing alternatives; on the one hand, to widen, improve, and straighten existing roads; on the other hand, to strike out along an entirely new line. It would usually be found that the balance of advantage inclined heavily towards the more courageous policy, particularly in the construction of bye-pass roads. It behoved all local authorities to co-operate with their neighbours in the preparation of well-thought-out road projects for embodiment in town planning schemes and for execution when time best served. Co-operation was, indeed, one of the first essentials of highway design. As regarded gradients, the practice of the road designer was converging towards that of the railway engineer, though with less rigid limitations. Extending the conception of highway design beyond the mere fences, a special reference to building line appeared indispensable, for the vast and widespread expenditure which was now being incurred in the widening of existing highways and in the creation of entirely new arterial roads and bye-passes, had been rendered necessary in no small degree by the lack of foresight on the part of our forefathers in allowing the main roads to become throttled by buildings.

Dealing with the question of road material, Colonel Bressey said it was surely as impossible to prescribe the " ideal " road material as the ideal motor car. One uniform prescription would not serve for Surrey and Sutherland. The search for the ideal was beside the question. Appropriate materials and sound methods had been discovered in plenty. In attempting to record the trend of development in road construction methods, the most conspicuous feature was the divergence between the two schools of thought, the search for complete rigidity on the one hand, and for elasticity or resiliency on the other. The rigidity, however, which was attainable by the use of a concrete foundation of sufficient depth, reinforced or not, was hardly applicable outside densely populated urban areas where a high initial cost could be faced. For the bulk of the country, inexorable financial considerations would lead the engineer to resort to methods in which reliance was placed on resiliency rather than rigidity.

THE DISCUSSION.

LORD MONTAGU OF BEAULIEU, in opening the discussion, wished that Col. Bressey had laid more stress on the very difficult financial problems which roadmakers had to face. Since 1914 the rateable value had gone up very slightly compared with the increased expenditure of local councils of all kinds. The constituents of every county council were determined to get a reduction in expenditure, and the almost universal desire was that there should be a reduction in the highway rate. This was very difficult, in view of the increased traffic, the demand for widened roads and better surfaces. The class of traffic for which we had to build our roads was the heavy traffic, which occasioned the most wear. The problem of the third class road was by far the more important problem left to us. We had not yet got over the difficulty of what we had to do for the little district councils whose roads were wholly of the third class grade (nearly three-quarters of the total road mileage of the country), and who were not willing to continue maintaining them for heavy, fast traffic. A way must be found for such small councils to use their local stone, rather than importing material. A great deal of education of the British public in road matters was required; if they could be made to understand that roads were vital to national prosperity, much would have been achieved.

Mr. J. CRACROFT HALLER (county surveyor of Nottinghamshire) regretted that so much money was spent by provincial towns on new roads, rather than on improving existing roads. What was wanted was the longest possible mileage of good roads; not wide roads just round about the towns. Referring to the desirability of the provision of national road statistics, Mr. Haller expressed a desire that comparable statistics of the cost in various counties should be included. The Notts County Council had decided to take over all first and second class roads as main roads. He himself

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would also take over third class roads and treat them as main roads, with the result that the whole cost of road maintenance would be spread over the whole county more equitably and more uniformly.

Major T. G. TULLOCH dealt with the corrugation of road surfaces, and said that while there was no hope of entirely eliminating road vibration itself, which was the cause, much could be done by making the surface more elastic and using, in conjunction, multi-wheel-drive vehicles.

Mr. REES JEFFREYS (chairman of the Roads Improvement Association) alluded to the construction, now proceeding, of arterial roads and emphasised the need for foresight by preserving land, in advance of its requirements, for road purposes, rather than allowing it first to be built upon and subsequently acquired at much expense. It was in this way that the financial problem would be solved. If the present arterial road schemes had been executed ten years ago, the cost would have been one-third or one-quarter of the present outlay. Labour would have been much cheaper and the roads could probably have been brought one mile nearer the centre of the town. If some legislation could be passed by which future road development could be foreseen and provided for, in advance of building requirements, many millions of pounds would be saved to future generations.

Lt.-Col. J. NALL, D.S.O., M.P., urged that the great national roads which are now being laid out must not be laid out in small sections—even if there were 50 miles to 100 miles in a section—without reference to the complete map of the country.

Mr. R. J. HOWLEY, a member of the Council of the Institute, said he had been impressed by the extensive widenings of certain roads, while neighbouring roads were not in an adequate state to carry the traffic. The matter was largely one of finance and it was not generally appreciated that the road work now being done was work of capital expenditure, as distinct from the mere repair of wear and tear. Roads were, in fact, being brought to a higher standard. He was, therefore, inclined to think that the cost should not be found out of rates and Government grants, but out of a loan raised for the purpose.

Others who took part in the discussion included Col. E. S. Sinnott, C.M.G. (county surveyor of Gloucestershire), Mr. J. Sutcliffe, borough engineer, Woolwich, Major E. A. Beaumont, Councillor Marlow Reed (M.C.C.), and Mr. A. S. Grunspan.

The CHAIRMAN urged that powers for securing land for new arterial roads should be granted to civic authorities. He hoped that the building line powers which were granted to Middlesex County Council last year would be extended by Parliament, not only to other county councils but to all road authorities. He also supported the plea for road reconstruction costs being found out of a loan, as the work would benefit future generations.

"SAFETY" IN RAILWAY OPERATION.

A paper on this subject was read by Col. J. W. Pringle, C.B., Chief Inspecting Officer of Railways, Ministry of Transport, on Friday, May 19. Sir Sam Fay presided. Colonel Pringle outlined the fundamental principles governing the safe conduct of traffic in respect of methods of operation, equipment, etc.; showed how accidents originate; and suggested directions in which these principles require to be either extended or reinforced, so that a higher degree of security in operation might be obtained. His remarks had reference mainly to conditions and practice on British railways. For more than thirty years the three basic requirements for safe operation had, he said, been universally recognised to be (*a*) adequate signalling combined with interlocking of points and signals; (*b*) block working upon double lines, whereby an adequate interval of space is ensured between trains, and token working on single lines; (*c*) the use of a continuous automatic brake.

Statistics showed that no such great immunity from accident connected with the movement of trains had been obtained as to warrant the conclusion that danger in the conduct of traffic was negligible. An examination of some 200 of the more serious accidents which had been fully reported upon during the past ten years had been made, and formed the basis for a number of conclusions. The first point to be noted from this analysis was that about 20 per cent. of the cases originated in failure of mechanism, equipment, etc., whilst 80 per cent. were directly due to failure of the human agent. It would appear therefore that there was greater need for additional safeguards against human than against mechanical failure. Colonel Pringle then gave an analysis of the cause of these accidents under various heads, and suggested possible remedies. In conclusion, he said that notwithstanding the criticisms of existing arrangements and the suggestions that had been made for improving "safety" conditions, it was readily acknowledged that a high degree of immunity from accident had already been obtained upon railways in this country. For this the responsible officers of British railways deserved the highest credit.

OPERATION OF HEAVY SUBURBAN PASSENGER SERVICES ON A STEAM RAILWAY.

This was the title of a lecture delivered on Friday, May 19, by Mr. F. V. Russell, C.B.E., Superintendent of Operation, Great Eastern Railway, at the rooms of the Royal Society of Arts, Adelphi. Mr. Arthur Watson, C.B.E., presided. Mr. Russell first explained that though the paper dealt with steam operated suburban services, he was by no means an advocate of steam as against electric operation. No one was more in favour of electricity for train working, and many other matters connected with a railway, than himself. With steam operation, especially in congested areas, there were many handicaps not experienced with electric operation. At the same time there were certain things of advantage in common use on electrically operated railways and not in common use on steam operated railways, that could be applied either directly or by equivalent means to steam operation. A steam locomotive was complete in itself, but required an enormous amount of attention and nursing to obtain the best results, attention in regard to coal, water and oil; nursing in regard to the maintenance of a good fire and a reasonable head of steam. Steam trains could frequently be made to travel considerably faster than they actually do over portions of their journey, but this would be at the expense of time taken on other portions of their journey. Such a condition of affairs could never within reason occur with electric traction, no matter whether the train was hauled by an electric locomotive or by electric motors on the carriage axles, the latter generally being arranged on the multiple unit system. The point he wanted to emphasise was that neither the motors on the carriage axles nor the electric locomotives were generators of power as was the case with steam locomotives, but were simply apparatus for converting a small portion of the power produced under most favourable conditions at some power station into a rotary motion of the driving wheels of the train. Consequently, an electric train could be forced up to the heating limit of its motors without in any way interfering with its performance on any other part of its journey.

FINANCE OF THE MODERN HIGHWAY—A PROBLEM AND A SOLUTION.

Mr. Dixon H. Davies, solicitor, Great Central Railway, read a paper on this subject on Friday, May 19. The president occupied the chair. The broad fact was, Mr. Davies said, that if the business of transport of goods by road was to be adequately provided for, and made to pay its way, it must be laid under charge for road provision and maintenance to the extent of something like 3d. per ton per mile. Apart from selected road routes to which metal plateways might be applied, the road system as a whole must be maintained at the common cost, and a proportion at least of the revenue must be collected by means of rates from the owners or occupiers of land and property who derived benefit from the transport facilities. For this purpose the present authorities should be reconstituted, and constituted, the writer submitted, *ad hoc*. They should also be given command of a capital account. It was not to be expected that local authorities charged with many other public services besides roads, having no pecuniary resources but the annual revenue from rates, and whose existence depended upon the votes of those who paid the rates, should be capable of framing a road programme based upon far-seeing policy. It must be apparent that parochial boundaries, fixed, they were told, in the days of King Alfred, were not suitable limits within which to confine the activities of those responsible for the unbounded traffic of motor transport.

On Wednesday afternoon many of the delegates accepted the invitation of the Metropolitan Railway Company to a number of places of interest in "Metroland"—the area north-west of London served by their line. A special train conveyed the party from Baker Street station to Rickmansworth and Chorley Wood, where the Cedars Housing Estate, in which the company is interested, was pointed out. Subsequently, the party were taken over the power station at Neasden, where they were shown the latest generating unit to be installed there, a 12,000 KW. turbo-alternator set. They saw also the boiler house, water-softening plant, the new switch house, one of the new type of high-power electric locomotive, and a super-heated steam locomotive. A halt was made at Wembley to enable the visitors to inspect the work upon the site of the British Empire Exhibition, 1924. The guests were entertained at luncheon at Rickmansworth, Mr. R. H. Selbie (general manager of the Metropolitan Railway Company), presiding.

Mr. H. E. BLAIN, in expressing the thanks of the Council of the Institute of Transport to the company, referred to the readiness with which they offered to entertain the delegates—a readiness which Mr. Blain described as "typical" of the Metropolitan Railway.

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Blain also complimented the hosts on a particularly artistic souvenir which they presented to their guests, and concluded by proposing the health of Mr. Selbie and prosperity to the Metropolitan Railway.

Mr. SELBIE referred to the delightful Hertfordshire countryside which the company were endeavouring to lay out, and said they were succeeding up to a point. Alluding to the Railway Act, he said the Metropolitan were neither grouped nor threatened with being grouped, and hoped to remain an individual company.

Other visits of inspection made on Wednesday were those to the London Docks, by special train on the Great Eastern; the Somers Town Goods Station of the Midland Railway; Marconi House, Strand, and the new Great West arterial road. In the evening, the Lord Mayor and Lady Mayoress of London (Sir John J. and Lady Baddeley) entertained the congress at a conversazione at the Mansion House.

One of the most interesting visits on Thursday afternoon was that made at the invitation of the Underground Company and the London General Omnibus Company to the latter's great overhaul depot at Chiswick and to the Underground Railway's power station at Lots Road, Chelsea. Special omnibuses conveyed the party from Westminster, and the delegates were conducted over the Chiswick depot by Mr. G. J. Shave (chief engineer and operating manager). The party were afterwards entertained at luncheon, Mr. H. E. Blain (assistant managing director of the Underground Company) presiding.

Mr. SIDNEY PRESTON, C.I.E., C.B.E., proposed a vote of thanks to the two companies for their hospitality, which he warmly commended Lt.-Col. Nall seconded and said that the Chiswick depot was an organisation without any real parallel throughout the world, and the General Omnibus Company might well take pride in the fact.

Mr. BLAIN, responding, said the chairman and managing director (Lord Ashfield)—who had been on the Continent—regretted his inability to be present. It was a very great and genuine pleasure to have that instalment of the congress visit their two works. Colonel Nall was probably correct when he said the Chiswick works were unique, for as far as the company knew, there was no similar plant in the world of such magnitude or with such a comprehensive basis.

At Lots Road power station, the visitors were shown over the whole splendid installation, from the boiler house, with its two floors and nearly 70 boilers, to the great turbine house, whose machines have a total capacity of 78,000 KW. They also saw the vast coal-handling and storage equipment and the ingenious circulating water screening pit.

Alternative visits on Thursday comprised those to Waterloo Station at the invitation of the L. and S.W. Railway, whose large marshalling yard at Feltham was afterwards visited (the journey being made by special train), and the aviation works of Messrs. Vickers Limited, at Weybridge.

THE ANNUAL DINNER.

A large and representative company attended the annual dinner of the Institute at the Savoy Hotel on Thursday evening, May 18. Sir Henry Maybury presided over a gathering of about 350. Among those who accepted invitations were the following—The Home Secretary (Mr. E. Shortt), the Minister of Transport (Earl Crawford), the Parliamentary Secretary to the Ministry (Mr. A. Neal), Lord Montagu of Beaulieu, Lord Gorell, Sir Sam Fay, Sir John E. Thornycroft, Capt. H. P. Riall Sankey, Sir W. M. Acworth, Sir J. Broodbank, Sir F. Gore Brown, Lady Ashfield (representing Lord Ashfield), Sir Raymond Dennis, Sir Lynden Macassey, Sir Phillip Nash, Sir H. White Smith, Lt.-Col. J. Nall, Mr. Arthur Watson, Mr. H. E. Blain, Mr. A. L. C. Fell, Mr. C. J. Spencer, Mr. G. J. Shave, Mr. Sidney Preston, Mr. R. S. Tilling, Mr. E. S. Shrapnell-Smith, and M D. A. van Heyst (Holland).

A tasteful musical programme was provided.

The HOME SECRETARY, in proposing the toast of the Institute of Transport, said he did not believe that the whole vocabulary of industry or commerce contained one word which meant so much as the word "transport." Not only did the Institute represent the great interests of every form of transport in the country, but it included in its membership some of the most eminent experts connected with each branch of the transport industry. There were railwaymen, tramwaymen and motormen who, meeting as they did for discussion within the Institute, must come to the conclusion that after all they were not really in competition and that if they would only work in combination and co-ordination, the position of everyone in the industry would be improved. Alluding to the formation of the Transport Ministry, Mr. Shortt said that whatever else the debates on the Bill might have done, they certainly brought the whole subject of transport to the front. Though the Institute was young among such bodies, it had potentialities before it greater, he believed, than those of any kindred organisation, because those potentialities were more widespread and essential to the whole industrial life of the nation. "You, I believe, will be the great heart of industry which will pump the blood through the arteries of trade. If you do that you will have done a great work, not only for the individual form of transport with which you are each connected, but for the whole commerce and industry of the great nation to which we belong." In submitting the toast, the Home Secretary coupled with it the name of Sir Henry Maybury—"one of the greatest experts on roads in this country."

The PRESIDENT remarked that he was sorry Lord Ashfield was not with them, but they had an extremely good substitute in her ladyship. He recalled how the idea of an Institute of Transport was first mooted by Lord Ashfield and pointed out that in three short years the membership had increased until it was now over 1,200. That was a very creditable rate of progress, having regard to the hard times through which they had passed. He did not think the Home Secretary put it too high when he said that the prosperity of the country depended upon efficient transport. The Institute had received great encouragement from members of H.M. Government, and he wished to thank the various right honourable gentlemen and noble lords present for according them recognition by attending that evening.

Mr. A. WATSON, C.B.E. (general manager of the London and North Western Railway) briefly proposed "The Guests," and remarked that they constituted a very representative list.

Mr. A. NEAL, replying, said the Institute was designed to make the men who controlled and served in the great transport organisations regard their industry not merely as a means of earning a living, but as an intellectual, a scientific and an elevating study, that would enable them to play their part in contributing to the prosperity of the land they all loved.

Mr. VAN HEYST tendered the thanks of the foreign delegates for the hospitality they had received in London, and remarked that the Dutch delegates had taken the opportunity to examine British methods of highway construction.

Among the tours of inspection on Friday afternoon was one to the Greenwich power station and the Charlton central repair depot of the London County Council tramways. The party made the journey from the Victoria Embankment in one of the latest types of double-deck cars (Class E.1), and were able to mark its speedy acceleration and general comfort. The general manager of the system (Mr. A. L. C. Fell) and members of his staff conducted the delegates in what proved to be a highly interesting tour of the Greenwich station, which covers an area of 3¾ acres. They first saw the frontage to the river and the pier, 200 feet in length, where coal steamers are berthed, and after examining the coal handling equipment and boilers, passed to the turbine house. Here, the last of the old four reciprocating engine-driven alternators has now been removed and will shortly be replaced by the fourth 8,000 KW. turbo-alternator. At the central repair depot, Charlton, the work of overhauling cars was observed in its various stages and attention was drawn to the extensive additions which are being made to the present buildings.

The delegates were entertained at tea and were welcomed by the chairman of the Highways Committee of the Council (Mr. C. W. Matthews). Mr. W. Murray (manager of Walthamstow Urban Council Tramways) proposed a vote of thanks to the Council for their hospitality and alluded appreciatively to the important part which the L.C.C. tramways played in the life of London.

Mr. FELL cordially returned thanks and said it had been a great delight to entertain the visitors and to show them that the tramways of London were still alive. "We are progressing, and like M. Coué, I think we are getting better and better every day." (Laughter and applause.)

On the same day another party of members was entertained by the Great Western Railway Company who first invited them to luncheon at the Paddington Hotel and afterwards took them out by train to Reading, where the company's works were inspected. An alternative visit was that to the London Terminal Aerodrome, Croydon, to which the members were conveyed by special train on the L.B. and S.C. Railway from Victoria.

Saturday, May 20, was wholly devoted to further interesting inspections. One, generally voted to be extremely enjoyable and instructive, was the visit to the Guildford works of Messrs. Dennis Brothers, Limited, commercial motor vehicle and fire engine manufacturers, of which an account is given in a subsequent page of this issue.

Other features of the congress programme on the final day included a visit to Liverpool Street Station at 8 a.m. to witness the handling of the incoming suburban traffic. (Breakfast was provided by the Great Eastern Railway Company.) An inspection of the L. and N.W. electric power station at Stonebridge Park, where the guests were subsequently entertained by the company; a visit to the Marylebone terminus to see Great Central locomotives especially equipped for burning low grade pulverised fuel and fuel oil; and a tour of the Central and London Trunk telephone exchanges. Free travelling facilities were granted the delegates to the congress on all public service vehicles—Underground trains, tramways and omnibuses.

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FINANCIAL REPORTS AND MEETINGS.

BIRKENHEAD CORPORATION TRAMWAYS made a profit of £2,247 on last year's working. This is in addition to the profit of £5,900 made on the motor omnibuses, which has been appropriated for rate relief.

BURTON-ON-TRENT CORPORATION TRAMWAYS.—There was a loss of £549 on the past year's working, compared with a deficit of £3,003 for the previous year. Including capital charges, the deficit was £4,624 against £6,459.

LA PLATA ELECTRIC TTAMWAYS.—The profit for 1921, after providing for debenture and other interest, was £2,720, making with £14,531 brought in £17,251. To reserve is placed £10,000, and the carry forward is £7,251, subject to Corporation tax, if any.

BARCELONA TRACTION, LIGHT AND POWER COMPANY are offering to holders of 5½ per cent. income bonds an opportunity to exchange for 6 per cent. (formerly 5½ per cent.) first mortgage bonds, on the basis of £1 nominal value of 6 per cent. first mortgage bonds for £5 nominal vale of income bonds.

BLACKBURN CORPORATION TRAMWAYS.—The annual report of the general manager (Mr. J. H. Cowell) shows that, after payment of interest on loans, sinking fund, etc., the net profit for the year is £1,646, compared with £751 in 1920-21. The decrease in mileage was 157,144, and in passengers 2,601,339.

NOBEL INDUSTRIES have declared a dividend on the ordinary shares on account of the year 1921 of 5 per cent., less income tax. After this distribution (which they propose to recommend as final for 1921), the estimates show there will be a balance on profit and loss account for the year to add to the amount carried forward (£757,498) as at December 31, 1920.

BLACKPOOL CORPORATION TRAMWAYS.—There was a disposable balance of £6,142 on the past year's working, as compared with £144 for the previous year. The total receipts were £261,989, and the aggregate working expenses £204,882. To the balance stated must be added £144, brought forward from the previous year, and, after deducting £50 deficiency on the omnibuses, the net balance is £6,236.

MERTHYR ELECTRIC TRACTION AND LIGHTING COMPANY.—The net revenue for 1921 was £21,074. Deducting administration and general expenses, debenture and other interest, and placing £5,000 to renewals account, there remains £5,002, plus £1,429 brought forward, making £6,431. The directors propose placing to reserve £1,200, a dividend of 6 per cent. on ordinary shares, the same as previous year, and carrying forward £1,331.

BRISBANE ELECTRIC TRAMWAYS INVESTMENT COMPANY.—The accounts for 1921 show a divisible balance of £132,487. A final dividend has been declared of 4s. per share, free of tax, making 8 per cent. for the year. The carry-forward is £46,162, subject to Corporation tax. The tramways working resulted in a net profit of £92,352, and £23,461 was brought forward. After providing £100,000 for payment of dividends, the sum of £15,813 is carried forward.

BIRMINGHAM DISTRICT POWER AND TRACTION COMPANY.—The net revenue for 1921 from tramways dividends and interest on investments was £99,830. After deducting payments to local authorities, income tax, etc., the surplus was £62,840, plus £4,508 brought in, making £67,348. After charging interest on debenture stock, providing for renewals, dividend on cumulative participating preference shares, and placing £9,430 to debenture sinking fund, the balance was £25,657. The directors recommend dividend of 6 per cent. on the ordinary shares, carrying forward £2,981.

BIRMINGHAM CORPORATION TRAMWAYS.—The accounts for the year ended March 31, 1922, show a net surplus after paying interest and sinking fund charges of £192,500. This amount is, however, absorbed by the large scheme of reconstruction undertaken during the year. The total revenue was £1,520,740, against £1,656,654, for the previous year, a reduction of £135,914, due chiefly to the trade depression. Operating expenses were reduced by £164,353 during the year, and the number of passengers carried was 183,500,000, compared with 218,000,000 in the previous twelve months.

JOHNSON AND PHILLIPS, LIMITED.—The report for 1921 shows a profit (including claim for repayment of excess profits duty), after making provision for bad and doubtful debts, and after charging to revenue upwards of £16,000 for maintenance of buildings, plant, etc., of £42,737, plus £38,727 brought in. Deducting directors' remuneration, debenture interest, etc., £18,428 for income and Corporation taxes, and £12,255 for depreciation on machinery, etc., there is to be carried forward £15,138. In view of the present state of trade caused by the engineers' lock-out and the consequently falling off of business, the directors do not recommend payment of a dividend.

MADRAS ELECTRIC TRAMWAYS (1904).—The accounts for 1921 show a gross profit of £34,661. After debiting interest and London office expenses, providing for debenture stock, sinking fund, and transferring £10,000 to depreciation and renewal account the balance is £9,744, and £5,555 was brought in, making £15,299. A dividend on the ordinary shares of 5 per cent. for the year, free of tax, is declared, and the sum carried forward is £6,436. Results for the past year were prejudicially affected by a strike which prevailed from January 10 to February 26, and by general depression which prevailed in India. During the strike a service of motor omnibuses was inaugurated and is still competing with the tramways.

TYNEMOUTH AND DISTRICT ELECTRIC TRACTION COMPANY.—The report for the year ended December 31 last shows that the total revenue amounted to £38,147 and expenditure, including the provision of £3,000 for renewals, to £34,286, leaving a balance of £3,860. This sum, added to the amount brought forward of £8,794, makes an available sum of £12,654, which the directors propose to appropriate as follows—Dividend on the 5 per cent. cumulative preference shares, £1,525; 10 per cent. on the ordinary shares, £4,641; leaving £6,488 to be carried forward. During the past year the company commenced operating a service of motor omnibuses in districts adjacent to the tramways, and the results were very satisfactory.

HUDDERSFIELD'S IMPROVED POSITION.—The chairman of Huddersfield Tramway Committee (Councillor T. Canby) informed the Town Council that the past year was begun with a deficiency of £15,086, but they now had the satisfaction of a balance of £3,105. The manager and staff were to be congratulated on the result. The money had been wisely spent, and they had obtained real and good results from the work. On the running of the omnibuses there had been a loss of £724, which was very satisfactory. There was a small loss for the first 15 months, but the omnibuses acted as feeders to the tramcars. At least 25 per cent. of the people who had been carried in the omnibuses had continued their journeys in the cars. The Council were also about to purchase seven new vehicles of a l ghter type than those now in use.

BRITISH ELECTRIC TRACTION COMPANY.—The report for the year ended March 31, 1922, states that the gross profit amounted to £262,895, compared with £264,772 in the previous year. Deducting general expenses, £44,401, there remains a net profit of £218,493 (against £220,197). Including the sum brought forward (£177,318), and after charging debenture stock interest (£84,451), and placing £14,676 to reserve, there is a balance of £296,684. This sum the directors propose should be applied as follows—Dividend of 6 per cent. on the cumulative participating preference stock, on which 3 per cent. has already been paid, and a dividend of 4½ per cent. for the year on the ordinary stock, leaving £194,237 to be carried to the next account, subject to Corporation profits tax for the years ended March 31, 1920, 1921, and 1922. The reserve now stands at £520,000.

CORK ELECTRIC TRAMWAYS AND LIGHTING COMPANY, LIMITED.—The report for the year 1921 shows that the revenue amounted to £114,772 and the expenses to £98,771, leaving a balance, including the amount brought forward, of £21,703. Deducting income tax £2,052, interest £4,851, and amount transferred for reserve for depreciation and renewals £12,000, there was a balance of £2,799 to be carried forward. In view of the heavy loss sustained by the company last year through the two months' strike of its employees, the subsequent coal strike, and the disturbed state of the country during the first half of the year, which severely affected business generally, the directors considered the results satisfactory. The capital expenditure during the year has been increased by £35,000, covering mainly the installation of a 2,000 KW. Curtis turbine and other plant at the Cork generating station.

ANGLO-ARGENTINE TRAMWAYS COMPANY.—The net revenue for 1921 was £303,647, making with £15,885 brought in £319,532. The directors recommend dividends on 5½ per cent. cumulative first preference shares for the year and on 5½ per cent. cumulative second preference shares in satisfaction of 12 months' arrears to December 31, 1917, carrying forward £6,032. At the 38th annual meeting of the Anglo-Argentine Tramways Company, held in London on May 31, Sir George A. Touche, Bt. (the chairman), said that the total receipts for the year were less by £135,000 and the total expenses more by £107,000. The position of the company was not satisfactory. The business should be self-supporting on a commercial basis. The City of Buenos Ayres was supplied with the finest tramway service in the world. Visitors were astonished at the development of tramway facilities. Yet those who supplied the service were receiving no return on a large part of their capital.

READING CORPORATION TRAMWAYS.—The annual report for the year ended March 31, 1922, of the general manager and the engineer (Mr. J. M. Calder) reveals a very satisfactory financial position, as compared with the previous year. There is a net profit on the combined tramways and omnibus undertaking of £2,988, against a deficit in the year before of £14,023. The revenue was £98,822, which compares with £99,924 last year, a decrease of £1,102. The

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tramway traffic receipts were £80,396, or 23d. per car-mile, as compared with £85,120, or 22·3d. per car-mile. The motor omnibus receipts were £17,398, or 24d. per omnibus mile, as compared with £13,916, or 21·5d. per omnibus mile, an increase of £3,482. The parcels express department shows a profit of £209, as against a loss of £309 last year. Traffic expenses show a decrease of £3,075, and general expenses a fall of £170. Repairs and maintenance cost £24,617, a reduction of £12,500; power expenses were reduced by £3,042 to £10,130. The passengers on the tramcars numbered 11,349,857, a decrease of 1,326,240. The total car mileage was 835,166, a fall of 79,213. The revenue of the omnibuses was equal to 24d. per omnibus mile, and the expenses to 21·2d. per omnibus mile. The Tramways Committee have resolved that the net profit be carried to the reserve, and have recorded their appreciation of the general manager and engineer's management of the undertaking.

POTTERIES ELECTRIC TRACTION COMPANY.—In their report for the year ended December 31, 1921, the directors state that the traffic receipts for the first few months showed substantial increases on both the tramway and omnibus services, but that the coal miners' strike, competition of independently-owned vehicles, and general trade depression caused a serious falling off in the number of passengers carried. Working expenses continued high during the year, and the report shows that the revenue amounted to £300,831. After deducting all expenses chargeable to revenue, including £11,025 for debenture interest and the provision of £10,000 for renewals, there remains £27,840, as compared with £28,500 for 1920. Including the sum of £6,082 brought forward, there is a balance available for distribution of £33,922. This sum the directors recommend should be applied as follows—To reserve account, £5,000; dividend on preference shares at 5 per cent., £12,250; dividend on the ordinary shares at 4 per cent. per annum, £9,800, leaving a balance of £6,872 to be carried forward. The reserve fund will then stand at £114,523, and the renewals fund at £55,891. The 24th annual meeting was held in London on May 26. The chairman (Mr. R. J. Howley, C.B.E.), commented on the keen competition with the tramway and omnibus services which was being experienced from the motor coach, omnibus and other vehicles. Little or no difficulty was experienced by any owner of a vehicle in obtaining the necessary licence from the corporation to ply for hire in competition with the tramways. This form of competition without restriction was unfair and unjust.

BRITISH THOMSON-HOUSTON COMPANY.

"A VERY SATISFACTORY REPORT."

In their report for the year 1921, the directors of the British Thomson-Houston Company, Limited, of Rugby, mention that the extensions to the Rugby works, which were begun in 1919, have practically all been completed. The changes in the works at Birmingham have been carried out, and the works are in operation. Owing to the expansion of the company's business, the London offices were removed to Crown House, Aldwych, W.C.2. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, were £509,258; including the amount brought forward from last year, £225,891, and deducting interest on debentures and loans, £119,446, there is an available balance of £615,703. The directors recommend that £160,000 should be appropriated for depreciation, reserves, etc., and that dividends should be paid of 7 per cent., free of tax, on the preference shares (£105,000) and 6 per cent. on the ordinary shares (£120,000), leaving £230,703 to be carried forward. During the year an issue of £1,500,000 par value 7 per cent. mortgage debenture stock was made, and the issue was largely over-subscribed. From the proceeds the company's indebtedness was substantially reduced, and since December 31 the entire amount due to the International General Electric Company, Inc., has been paid off.

The 27th annual meeting was held at Crown House, Aldwych, on May 30. Mr. H. C. Levis (the chairman and managing director) presided, and said he thought the report would be considered very satisfactory. The volume of unfilled orders on hand at the end of 1920 was such that, notwithstanding the fact that during 1921 the orders received were less in volume than for the previous year, the output for 1921—the amount billed to customers—was the greatest in the history of the company. This large output was responsible for the satisfactory results appearing in the balance sheet. Notwithstanding the general depression throughout the country, the volume of orders received by the company this year to date was over 37 per cent. in excess of the orders received for the corresponding period of 1921. The company now had on hand orders to the value of over £2,250,000. The volume of inquiries was very large, and while the proportion which had resulted in orders was not as great as in 1920, there was still a great demand for electrical machinery which must be satisfied sooner or later, and from which they confidently expected to get their fair share of business. During the year the expenditure on factories was over £450,000, principally in connection with the new Birmingham factory, the new glass works which they were erecting at Chesterfield in connection with their electric lamp business, and extensions to the Rugby plant, which would be completed during the current year.

In a brief allusion to industrial disputes, Mr. Levis expressed the hope that all outstanding differences would soon be amicably adjusted, and added that the personal relations between their own employees and management were satisfactory. The meeting terminated with a hearty vote of thanks to the chairman, directors and staff.

THE ENGLISH ELECTRIC COMPANY.

ANNUAL REPORT AND MEETING.

The report of the English Electric Company, Limited, for the past year shows that the net profits, including amounts transferred from reserves previously set aside and no longer required, total £317,423. The ordinary dividend is reduced from 8 per cent. to 5 per cent., less tax, and, after transferring £60,000 to reserve for contingencies, a balance of £55,599 is carried forward, against £46,236 brought in. The falling off in orders which was general in the steel and engineering trades in the earlier part of the year under review was accelerated by the prolonged coal strike, with the result that during the later months some of the company's works were not fully employed. But for this handicap the available profits would have been higher. In view of the heavy fall in the price of materials during the past year the directors have considered it advisable to write down the stocks of materials, etc., held by the English Electric Company and its subsidiaries, so as to reduce them to current market values or less, and this decision has been given effect to in the accounts under review. It is pointed out that the variations of the assets shown in the balance sheet as compared with the figures of the previous year are chiefly the result of the progress which has been made towards completing the amalgamation of the company's subsidiaries, the Dick, Kerr Works at Preston having been transferred to the English Electric Company in April last year, and the Coventry Ordnance works having been leased as from January 1, 1921.

Sir Charles Ellis, G.B.E., K.C.B., presiding at the annual meeting on May 16, referred to these changes, and said they accounted for the increase in the item, "stocks, works in progress, and debtors." In the aggregate, stocks were very much reduced during the year. As early as 1920 they foresaw that, although orders still continued to flow in, the market was, in fact, being exhausted. Consequently they reduced their stocks to the lowest possible limits. They had met the heavy fall in the market value of materials by the special writing down of stocks to a figure which represented to-day's replacement value or less. The available balance shown in the report was slightly in excess of that for last year. The results were satisfactory, but they felt bound to look ahead, and there were uncertainties on every hand. The state of things abroad was unprecedented; many foreign markets were closed; others still languished. The engineering industry had to face during 1922, owing to a serious industrial dispute, peculiar difficulties. In these conditions what might be regarded in normal times as exceptional prudence became an indispensable precaution. Full wisdom lay in the mean, and the board, in recommending a dividend on the ordinary shares of 5 per cent., considered that they had not unfairly reconciled the natural expectations of shareholders with the needs of a difficult and obscure period to come. Referring to the chaotic condition of the markets, he said that while they welcomed Government assistance, both direct and indirect, particularly as regarded finance, he was strongly of opinion that the best way out of the present difficulties would be found through the efforts of private enterprise. With the assistance of five powerful associations of world-wide reputation, they had recently formed the Power and Traction Finance Company, Limited, with the object of dealing with comprehensive engineering contracts on a large scale. In spite of general economic conditions, it remained true that the electrical industry had been less seriously affected than many others. It had the advantage among the industries of this country of youth and vigour. During the last year they had secured many important contracts. Among them were a complete central station installation for the borough of Leicester, and important railway electrification contracts in Spain and Japan. On the technical side, their business had been one of ceaseless activity. In many cases entirely new lines of machinery had been developed. The effect of specialising certain factories to particular kinds of operation had already resulted in reduced costs and better production.

Lights on Vehicles Legislation.—The Parliamentary Secretary to the Ministry of Transport has stated in the House of Commons that the Government hoped to be able before the end of the session to introduce a Bill dealing with the regulation of lights on road vehicles.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ASHTON-UNDER-LYNE

TRAMWAY CHAIRMAN'S CLAIM.

Alderman R. S. Oldham, chairman of the Corporation Tramways Committee, claims that their cars carry more passengers per mile than any other tramway service in the country.

BLACK COUNTRY.

JOINT TRAMWAYS BILL.

The five Black Country tramway companies who are promoting a Bill in the present session of Parliament to synchronise the various dates of optional purchase of their respective undertakings by the municipal authorities are reported to have reached an agreement with these bodies. This will ensure that the Bill will go through as an unopposed and agreed measure. The date fixed for the exercise of the municipalities' option to purchase is, with slight exceptions, December 1938. The tramway companies concerned are—The Birmingham District Power and Traction Company; Dudley, Stourbridge and District Electric Traction Company; South Staffordshire Tramways Company; South Staffordshire Tramways (Lessee) Company; and the Wolverhampton District Electric Tramways. A clause will appear in the Bill by which the companies will be obliged, after July 1, 1923, to abandon the 2d. minimum fare, and substitute one of 1½d.

BRADFORD.

STIPENDIARY AND STATIONARY TRAMCARS.

The Bradford Stipendiary gave judgment on May 19 in a case in which a partner in a Halifax firm of motor haulage contractors was summoned for not keeping a motor wagon on the right or off side of the road when passing a certain carriage. The Stipendiary said it was contended by the prosecution that under Section 28 of the Town Police Clauses Act 1847, the defendant, in passing two tramcars which were standing almost side by side, should have kept to the off side of the road, as there was not sufficient reason for deviation to the left. Defendant contended that the tramcar was not a "carriage" within the meaning of the Act; and that, assuming the Act applied, then the fact of there being two stationary cars close together on different lines created the actual necessity or sufficient reason for deviation to the left. He (the Stipendiary) considered that in the present case there was such a condition of things as amounted to a case of actual necessity or sufficient reason for deviation, especially excepted in the Act. The summons was dismissed.

BRISTOL.

REDUCTION OF FARES.

The fares of the Bristol Tramways and Carriage Company were revised on May 8. The minimum fare was reduced from 2d. to 1½d., which had been the minimum until February last year. Workmen's fares were lowered, and special rates were granted to children.

BURTON-ON-TRENT.

STIMULATING TRAMWAY TRAFFIC.

With the object of popularising tramway travel, the *Burton Daily Mail* proposes for some weeks to offer a prize of £1 per week for the most accurate forecast of the week's tramway receipts of the Burton-on-Trent Corporation Tramways. The *Mail* hopes that the offer "will draw attention to the working man's car, and at the same time induce more people to ride and do something toward making the trams a paying proposition."

CROYDON.

FUTURE OF THE TRAMWAYS.

Addressing a special meeting of the Chamber of Commerce, Councillor A. A. Thomson (chairman of the Corporation Tramways Committee) said he held the view that with a properly reconstructed track and up-to-date equipment and service there was no reason why Croydon should not make the tramways service pay as well as the London County Council might do. He thought they had an undertaking which should be retained for the benefit of the borough and suggested that tenders should be invited for the reconstruction of the track from Norbury to Purley.

DUBLIN.

SUNDAY SERVICE IN ABEYANCE.

The service of the Dublin United Tramways Company was stopped on Sunday, May 21, owing to the failure of negotiations between the management and their employees regarding payment for time worked on Sundays beyond the specified and agreed 48-hour week. The men, who are members of the British Transport and General Workers' Union, ask that any hours worked on Sunday over and above the 48 should be paid for at the rate of time and a half per hour. The directors of the company stated that they had not even had an opportunity of investigating any cause of complaint, and feel sure that this sudden stoppage cannot be justified. An agreement has now been reached between the company and the men, whereby the latter now work seven hours on Sundays.

DUNDEE.

ACTION AGAINST CORPORATION—SEASON TICKETS.

The action of interdict brought by Dundee, Broughty Ferry and District Tramways Company against Dundee Corporation to stop the latter from running an omnibus service from the High Street, Dundee, to Castle Green, Broughty Ferry, was concluded in the Court of Session on May 20. The respondents contended that the omnibus service was being conducted purely, and as a temporary measure, for testing traffic. Complainers asserted that it was not merely a test service, and that it was causing them to lose money. Lord Blackburn reserved judgment. Season tickets are to be introduced on the Corporation Tramways. The committee cannot recommend an all-round reduction of fares at present, but cross-over fares are to be inaugurated.

EDINBURGH.

THE PRINCES STREET REPORT—CENTRE POLE DESIGN.

The report of Sir William Marwood and Colonel Pringle on which the Transport Ministry has already authorised the erection of centre poles in Princes Street has now been published. Generally speaking, the report says, the inquiry resolved itself into a question of the respective merits of centre pole construction and the conduit system. It was not denied (it is pointed out) that the conduit system was more expensive to instal and also to operate. "Although some deduction may be made from the additional cost of the conduit system as estimated by the Corporation, we think that an estimate of, say, £12,000 as a total additional annual cost under all heads might reasonably be anticipated. This would represent an increased cost, based on the present service of the cars, of rather more than 3½d. per car-mile run in Princes Street." Dealing with the question of practicability or reliability of the two systems, the report states that "there is not much to be said," and referring to the effect of centre poles on other traffic, the document asserts that in view of the width of Princes Street the traffic objections are not insuperable. As regards the question of amenity, the report says—"It is impossible to fix any monetary value for amenity . . . but, taking all circumstances into consideration, we have come to the conclusion that we cannot recommend you to refuse the permission which the Corporation ask." It is suggested, however, that the Corporation should consider the position of certain refuge platforms in the street, and the distance between the poles might be extended to 50 yards where it would facilitate the passing of traffic out of the side streets. The tramways sub-committee have rejected the design for the Princes Street centre poles provided by the Edinburgh College of Arts, on the ground that the scroll work at the top was too elaborate. A simpler design has been adopted, and 33 of these standards will be erected. The existing 39 electric standards will be removed from Princes Street, and under the new arrangement there will be fewer poles than formerly.

FALKIRK.

LICENCES OF TOWER REPAIR WAGONS.

The Falkirk and District Tramways Company were fined £10 at Falkirk on May 8 for having used a motor tower repair wagon for which a proper licence was not in force. For the prosecution it was stated that while the respondents had made an application to the County Council for a 5s. licence, this was not considered adequate, as the vehicle, not coming under the category of a tractor, was liable to £25 duty annually. The Tramway Company contended that the vehicle was a tractor within the meaning of the Act. Sheriff Robertson stated that he could not conceive any definition of tractor which would be wide enough to include the vehicle in question that would not also include every motor lorry used to carry any kind of burden. The general feature of all tractors, he thought, must be that they drew their burden behind them and did not carry it. He entertained no doubt but that the respondents failed to tender the appropriate amount of duty payable, and therefore he must convict.

GLASGOW.

OFFER TO PURCHASE THE SUBWAY.

The Corporation decided on May 25 to offer £385,000 for the Glasgow Subway, this figure including £100,000 for properties above ground. The subway has been closed for some months, and it was stated that an expenditure of about £100,000 would be necessary to convert the system from cable to electricity, and bring it up to date. The directors originally asked £500,000, and pointed out that it was only one-third of what the tunnels cost when constructed about twenty-five years ago. It was also stated that the Board are now prepared to recommend the shareholders to accept the £385,000, which would admit of them being paid 10s. for each £10 share. The Corporation's offer has since been accepted.

HULL.

TRAMWAY EXTENSION VETOED.

The Ministry of Transport have refused the application of the Corporation for a light railway order to construct an extension of the tramways to Hessle. The estimated cost of the scheme was £70,000.

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LEEDS.

EXPRESS TRAMWAY ROUTE OPENED.

The new "express" tramway route of the city tramways from Harehills to Oakwood (which was illustrated and described in our issue of March 16, 1922) was informally opened for traffic on Sunday, May 21. The track, which is laid on sleepers railed off at the side of the road, was previously inspected by Major Hall, of the Ministry of Transport. The construction of the remainder of the express route along Prince's Avenue to Roundhay is proceeding.

LIVERPOOL.

INSPECTION OF THE TRAMWAYS.

The Corporation Tramways and Electricity Committee made an inspection, on May 18, of Lambeth Road Works, where a number of tramway cars are being repaired and some new ones constructed. At luncheon at the Midland Adelphi which followed, Dr. Utting, chairman of the Finance Committee, observed that one of the best ways of enabling City Councillors to familiarise themselves with the work that was going on was to arrange for such inspections. Liverpool's tramway operations were improving. Cheap and inexpensive transit was vital to the development of the city, and he congratulated the committee upon the recovery of their undertakings from the stress and strain of the war. The chairman of the committee (Mr. Frank Wilson), who presided, gave a *résumé* of the year's working. They had spent large sums during the last three years in renewals. They had now 618 cars in service, of which 450 were twenty years old. Many of them ought to be scrapped. He thought their increased fares were justified, but later in the year they hoped to consider the question of cheaper fares. Mr. J. A. Brodie, city engineer, said that the new Prescot Road was a typical arterial road which would develop the city and its environs. The expense of its construction was being borne by the Corporation, the Lancashire County Council, and the Ministry of Transport.

LONDON.

PROGRESS OF TRAMWAYS BILL—THROUGH SERVICES.

A Select Committee of the House of Commons, presided over by Mr. Ormsby-Gore, on May 10 considered the London County Council (Tramways, Trolley Vehicles, and Improvements) Bill. When the Bill received its second reading it contained a proposal that powers should be given to construct a trolley vehicle route from West Norwood to Lee Green, but the Select Committee was informed that as the local authority—the Lewisham Borough Council—had exercised its right of veto, that part of the scheme had been dropped. The remainder of the Bill was concerned with the construction of an electric tramway of about five-eighths of a mile along Amhurst Park, connecting the London County Council tramway at Stamford Hill and that of the Metropolitan Electric Tramways Company (who opposed the Bill) in Seven Sisters Road. It was explained that the local authorities concerned desired that the tramways should be made. The only opposition came from the Metropolitan Electric Tramways Company, with whose line in Seven Sisters Road it was proposed to make a junction. The chairman said the Committee had unanimously agreed to pass the preamble of the Bill If the ground for the rejection of the Bill was to be congestion, the Committee would have expected that the Ministry of Transport and the police authorities would have had some observations to make, but no such observations had been made. It did not seem that the Metropolitan Company had made out that their property would be damaged, or in any way rendered less valuable or productive. The Committee therefore agreed to the Bill. In the House of Commons on May 22 the Bill passed the report stage, and was ordered to be read a third time. The Council began on May 2 to operate the whole of the services on the lines of the London United Tramways, Limited, between Wimbledon and the county boundary at Merton, and to run one service to the county boundary at Hammersmith and thence along the company's lines to Kew. Owing to the refusal of the Wimbledon Corporation to consent to the use of trailer cars on the Merton to Wimbledon tramways, trailer cars coming from the Victoria Embankment have to be detached at the county boundary at Merton.

MIDLANDS.

VESTIBULE FRONTS RECOMMENDED.

The Midland Area Industrial Council for the Tramway Industry has recommended all the undertakings within its district to adopt the vestibule front for all cars. It is urged in support of the request that the dust which is now thrown up from the roads by motor vehicles affects the eyes and the bronchial tubes of the drivers of the cars. The enormous increase in motor traffic has, it is maintained, rendered more protection necessary.

NEWCASTLE-ON-TYNE.

TRAMWAY EXTENSIONS.

The Corporation Transport and Electricity Committee have made good progress with their tramway extensions. The Fenham extension across the Two Ball Lonnen and on to the main Westerhope Road and the diversion to Newburn were expected to be opened this month. The new track to Slatyford was opened on June 1. The route is a continuation, 1¼ miles in length, beyond the present Wingrove Road terminus, and includes several loops and some sections of double track. An inaugural run over the new line was made by members of the Transport and Electricity Committee and of the Corporation, together with various officials. Alderman R. Mayne (chairman of the committee) drove the first car over the route, and among others present were Councillor Sir Arthur M. Sutherland, Bart., K.B.E. (vice-chairman of the committee), Mr. Ernest Hatton (general manager of the tramways), and Major W. J. Steele (city engineer). Omnibuses meet the cars at Slatyford for Westerhope and Whorlton.

PLYMOUTH.

TRAMWAY COMPANY'S LEASE EXPIRES.

Plymouth, Stonehouse and Devonport Tramways Company will cease to exist as a separate undertaking on June 30, on account of expiration of the lease, and the system will be transferred to the Plymouth Corporation. The whole of the services after that date will be run entirely with the present Corporation rolling stock, but a number of the cars purchased from the tramways company will be reconstructed and utilised as soon as practicable. The employees of the company, numbering 62, have been given the opportunity of applying for employment with the Corporation, and nearly all of them have done so. The general manager of the Plymouth, Stonehouse and Devonport Company is Mr. A. E. Maddock.

PERSONAL.

Sir Eric Geddes has been elected to the Board of the Dunlop Rubber Company.

Sir William Noble, who recently retired from the position of engineer-in-chief to the Post Office, has accepted a seat on the Board of the General Electric Company.

Mr. G. Hammond Etherton, who has been Town Clerk of Liverpool for the past 18 months, was on June 1 appointed clerk to the Lancashire County Council at a salary of £5,000 a year. His salary at Liverpool was £3,500.

Mr. Edward H. Fleming, who for the past 14 years has been associated with the Anti-Attrition Company, Limited, has resigned his position with that company and has joined Messrs. P. R. Metals, Limited, of Brentford.

Sir Sam Fay has accepted the presidency of the Institute of Transport for the twelve months commencing September next, in succession to Sir Henry Maybury, director-general, Roads Department, Ministry of Transport.

Colonel R. R. Greene, general manager of Wallasey Corporation Tramways, has reached the retiring age of members of the Corporation staff, but the Finance Committee are recommending the Council that he be asked to retain his position until December 31 next.

Mr. Thomas W. How, M.I.Mech.E., F.C.I.S., after 25 years' service as managing director and secretary of the Empire Roller Bearings Company, Limited, is shortly resigning that position in order to resume his general practice as a consulting engineer and as an expert in roller and ball bearings, at 13 Victoria Street, Westminster, S.W.1.

Mr. A. J. Abraham, tramways manager and electrical engineer of the Aberdare Urban District Council, has resigned his position in order to become electrical engineer and manager of Bexley (Kent) Urban Council Tramways. The Aberdare Council have accepted his resignation with regret, and are advertising for a manager at a basic salary of £450 per annum, plus bonus.

Mr. H. H. Lancaster, executive officer of Blackpool Corporation Tramways, who has been appointed traffic manager in succession to Mr. C. I. Baker, will receive a salary of £400 a year, with bonus, making not more than £500. Many of our readers will remember that Mr. Lancaster's father, the late Mr. James Lancaster, was for many years general manager of the Blackpool Tramways.

Mr. D. H. Duff, works manager of the motor constructional department at Brislington of the Bristol Tramways and Carriage Company, has died at the age of 38 after an operation for appendicitis. He was the son of Mr. Daniel Duff, for many years general manager of the London Road Car Company, and now a director of the London General Omnibus Company.

We regret to record the death of **Mr. John Martin,** the head of the Alternating Department of the British Thomson-Houston Company. Mr. Martin died on May 23 at his residence in Rugby. On leaving Glasgow University, where he took the degree of B.Sc., he entered the works of the British Electrical Plant Company at Alloa, and in 1903 joined the British Thomson-Houston Company at Rugby.

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CONTRACTS AND ORDERS.

Bradford Tramways Committee have decided to purchase 12 pairs of manganese steel points from Hadfield's Limited.

Blackpool Tramways Committee have accepted the tender of Tilling Stevens Motors, Limited, for the supply of a double-deck omnibus for the Thornton-Cleveleys service.

Edinburgh Town Council have accepted the tender of the British Mannesman Tube Company, Limited, for single tramway standards for erection in Princes Street at £16 15s. each.

Glasgow Tramways Committee have recommended acceptance of the tender of the Metropolitan-Vickers Electrical Company for reconstructing car magnetic brake equipments, and adding skid-proof attachments.

The Bristol Tramways and Carriage Company, Limited, have received from the Yorkshire (West Riding) Electric Tramways Company, Limited, a repeat order for ten "Bristol" single-deck omnibuses, similar to those recently supplied to that company.

The Premier Electric Welding Company, Limited, of Abbey Wood, London, S.E.2, have received an order from the London County Council tramways department for two complete "Premier" electric arc welding equipments of the self-contained motor-generator type.

Leeds Tramways Committee have accepted the following tenders—300 steel tyres, Vickers, Ltd., the Monkbridge Iron and Steel Company, Ltd., and Cammell Laird and Co. Ltd., in equal proportions. Special trackwork, Edgar Allen and Co. Ltd., the Titan Trackwork Co. Ltd., and Hadfields, Ltd.

Sheffield City Council proposed to place an order with Steel, Peech and Tozer, Rotherham, for 200 tons of steel tramway rails at £12 10s. per ton. The firm, however, approached the Tramways Committee with a view to increasing the order, and it is now proposed to give them an order for 500 tons at £11 10s. per ton.

New Trucks for Edinburgh.—The Edinburgh Corporation have been recommended by the Tramways Committee to place an order with the Brush Electrical Engineering Company, Limited, for 110 Peckham patent pendulum geared trucks at £13,310. When these have been delivered, there will be over 160 Peckham trucks of this type in service in Edinburgh.

Bournemouth Tramways Reconstruction.—The reconstruction of a portion of these tramways, now nearly completed, comprises a total of about 12 miles. The work has been carried out under the instructions of Mr. I. Bulfin, general manager of the Bournemouth Corporation Tramways, by the well-known firm of tramway and general contractors, William Griffiths and Company, Limited, of Hamilton House, London. Included in their contract was a considerable area of wood paving in the breasts of the roads, and this was carried out under the instructions of the borough engineer, Mr. F. P. Dolamore. Messrs. William Griffiths and Company also reconstructed a large section of the tramways just previous to the outbreak of the war.

PATENT LIST.

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given in italics.

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Multiple control apparatus for electric railways (12,862)—Akt.-Ges. Brown, Boveri et Cie.
Tramcars and tramway tracks (12,411)—J. R. Cahill.
Lengthened motor car chassis and wheel base (12,125)—H. Crompton.
Electrically propelled vehicles (12,508)—J. E. Hamilton and Industrial Appliances, Limited.
Vacuum brakes for vehicles (12,657)—E. S. Luard.
Power transmission gearing for road vehicles (12,851)—E. MacHarg.
Tramrails (12,268)—J. Murphy.
Rail ties and fasteners (12,456)—A. Pokorny.
Means for operating and releasing brakes on tramcars, etc. (12,562)—A. Wheatcroft.
Rail chair or bearing plate (12,463)—H. Williams, Limited, and L. C. Williams.
Overhead electric tramway systems (13,330)—F. Ainsley and W. Platt.
Tramcars, etc. (13,087)—A. C. H. Butler and B. W. Elkington.
Electrically driven road vehicles (13,341)—F. Crawford.
Manually operated controllers for electric traction (13,080)—R. G. Cunliffe.

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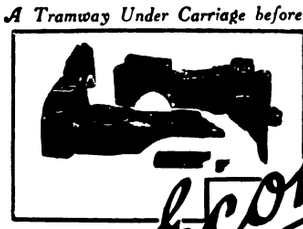
A Tramway Under Carriage before—

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Ventilators for passenger vehicles (13,054)—E. L. Ford.
Liquid operated brakes for motor vehicles (13,518)—G. Fornaca.
Controllers for electric traction (13,080 and 13,082)—Metropolitan-Vickers Electrical Company, Limited.
Life-guards for vehicles (13,305)—J. J. O'Farrall.
Lifting jacks (12,889)—W. L. Spence.
Braking mechanism for motor vehicles (13,301)—A. H. Wilde.
Motor vehicles (13,485)—F. Winterbottom.
Motor vehicles (13,978)—A. S. Abbott and J. Abbott.
Brakes for motor vehicles (14,159)—J. Bachelor and the Triumph Cycle Company, Limited.
Trolley poles for overhead systems of electric traction (13,779)—Brecknell, Munro and Rogers, Limited, and H. I. Rogers.
Undertrucks for tramcars, etc. (14,219)—G. N. Cadbury, Electro-Mechanical Brake Company, Limited, and E. M. Taunton.
Motor vehicles (13,900)—G. F. Fawcett and International Motors, Limited.
Liquid fuel consumption indicators for motor vehicles (13,790)—J. Higginson.
System of transference of vehicles from one set of rails to another (13,891)—R. Kelly.
Steering gears for motor vehicles (14,214)—J. A. Prestwich.
Motor vehicle steering indicator (13,841)—G. D. Quayle.
Vehicle life-guards, etc. (13,944)—P. Roberts.
Joints for steering mechanism of vehicles (14,155)—A. A. Sykes and the Triumph Cycle Company, Limited.
Engine, etc., brackets for motor vehicles (14,156)—A. A. Sykes and the Triumph Cycle Company, Limited.
Steering pillars for motor vehicles (14,157)—A. A. Sykes and the Triumph Cycle Company, Limited.
Driving axles and axle castings for motor vehicles (14,158)—A. A. Sykes and the Triumph Cycle Company, Limited.
Brake shoes of tramway vehicles (13,796)—T. C. Way.
Coach and motor car body construction (14,512)—Art Products, Limited, Forton and Bettens, and E. J. Bettens.
Electric lighting and starting installations for motor vehicles (14,820)—R. Bosch Akt.-Ges.
Tramway vehicles (14,470)—B. W. Dawkins.
Fish-plate rail joints (14,377)—T. F. Fox.
Motion transmitting system for motor vehicles (14,880)—C. A. Krogsgaard.
Power-driven vehicles (14,646)—E. C. R. Marks (*Atlantic-Akt.-Ges. für Automobilbau*).
Change-speed gearing for motor vehicles (14,375)—R. W. Maudslay and Standard Motor Company, Limited.
Change-speed gear for motor vehicles (14,861)—W. W. Moore.
Transmission gears for motor vehicles, locomotives, etc. (14,640 and 14,814)—H. C. Phillips.
Tramcar (14,497)—G. F. Slemon.
Controlling mechanism for brakes of trailers (14,519)—Soc. Anon. A. Saurer.
Splash-guard for motor vehicles (14,697)—R. Thacker.
Tramway steel line trimmer and cleaner (14,800)—W. Wye.

Specifications Published

1920

Motor road vehicles (36,632—*177,857*)—J. D. Siddeley.
Self-contained internal combustion driving unit for motor vehicles (34,580—*178,158*)—H. P. Saunderson.
Motor vehicles (36,224—*178,891*)—A. E. Alexander (*Three Point Truck Corporation*).

1921

Lifting jacks (1,697—*177,888*)—E. Faure.
Motor vehicles (6,413—*177,960*)—J. R. Kingston and W. H. Powell.
Construction of portable hand ticket racks or holders used by omnibus and tramway conductors (6,856—*177,964*)—J. R. Cross.
Device for automatically lubricating tramway axles (8,549—*177,982*)—A. J. M. Jones.
Transmission systems for mechanically propelled vehicles (10,240—*178,001*)—H. Woods and R. F. W. Manthorpe.
Gear boxes for use on motor vehicles (10,656—*178,002*)—G. Funck.
Anto-skid devices for road vehicles (452—*178,178*)—J. O. M. Taunton, E. F. O. M. Taunton, W. O. M. and B. T. Taunton.
Motor vehicle bodies (6,475—*178,269*)—Charlesworth Bodies, Limited, and C. Steane.
Steering gear for motor vehicles (18,304—*166,131*)—Columbia Carburetter Company.
Electrical trip switches for tramway and like indicating mechanism (1,514—*178,518*)—P. H. Waller.
Sockets or bases of trolley poles for electrically propelled vehicles (9,604—*178,701*)—E. M. Munro.
Levers or point boxes for operating switches on tramways (5,086—*178,990*)—O. R. Williams.
Coupling rod drive of driving axles of electrically driven vehicles (6,009—*179,008*)—E. C. R. Marks (Akt.-Ges. Brown, Boveri et Cie.
Seats for motor vehicles (6,715—*179,018*)—Charlesworth Bodies, Limited, and O. J. Critchard.
Brake levers for motor vehicles (8,857—*160,733*)—L. Feugere.
Brake release spring mechanism for tramcars (20,992—*167,502*)—J. Leah.

1922

Steering gear for self-propelled vehicles (6,589—*179,125*)—R. Venzlaff, W. von Mumm and A. von Munm.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1921. WEEKS ENDED May 7	May 14	May 21	May 28		1922. WEEKS ENDED May 6	May 13	May 20	May 27		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,221	2,623	1,669	1,722	...	3,399	3,652	3,523	3,588	...	51¾	179,837	− 9,447
Aberdeen Motor Buses	177	254	445	606	...	266	193	191	225	...	51¾	11,300	+ 8,148
Ayr Corporation	619	608	534	672	...	597	542	452	772	...	2	1,223	+ 16
Barrow Corporation	899	819	1,161	921	...	586	563	548	597	...	8	4,778	− 2,484
Belfast City Tramways	13,687	12,972	13,204	13,128	...	12,251	12,607	12,124	11,122	...	8	96,608	− 7,677
Birkenhead Corporation	2,390	2,324	2,645	2,296	...	2,593	2,487	2,560	2,636	...	8¾	21,080	+ 98
Birkenhead Motor 'Buses	609	686	975	760	...	656	681	740	769	...	8¾	5,745	+ 327
Birmingham Corporation	30,571	29,479	30,355	25,559	...	29,020	29,275	28,784	29,615	...	8	234,871	− 14,344
Birmingham Motor 'Buses	2,081	2,087	2,902	2,410	...	1,786	1,923	1,891	2,108	...	8	14,970	− 3,306
Blackburn Corporation	1,732	1,102	1,530	1,157	...	2,262	2,560	2,399	2,535	...	8¼	20,674	+ 2,636
Bradford Corporation	12,182	12,007	14,706	10,940	...	13,904	14,101	14,441	14,477	...	9	115,737	+ 3,575
Burnley Corporation	948	1,445	2,450	2,607	...	3,256	3,307	3,216	3,304	...	—	—	—
Burton-on-Trent Corporation ...	644	686	646	561	...	571	525	540	565	...	8	4,523	− 629
Bury Corporation	2,228	1,950	2,502	2,176	...	2,478	2,520	2,578	2,615	...	8¾	20,788	− 15
Chatham and District	1,680	1,458	1,816	1,550	...	1,597	1,768	1,696	1,921	...	21	32,091	− 2,168
Chesterfield Corporation	1,362	1,360	1,467	1,461	...	1,218	1,269	1,218	1,204	...	7	9,412	− 1,088
Derby Corporation	1,919	1,939	2,320	1,614	...	2,047	2,149	2,119	2,229	...	8	17,412	− 355
Dundee City	3,473	3,368	...	3,526	...	3,054	2,992	...	3,074	...	1¾	3,893	− 528
East Ham Corporation	2,145	1,965	2,453	2,028	...	2,115	2,165	2,168	2,247	...	8¼	17,741	+ 452
Edinburgh Corporation	...	...	11,961	14,784	...	12,118	14,891	9,193	16,236	...	2	24,469	− 3,776
Edinburgh Motor 'Buses	...	...	3,630	8,520	...	3,553	4,398	2,691	1,586	...	2	7,287	− 1,233
Glasgow Corporation	49,956	49,351	49,844	51,093	...	44,796	45,313	44,636	46,123	...	51¼	2,321,849	− 38,082
Glossop (Urban Elec. Supply Co.)...	269	242	246	219	...	231	221	215	229	...	21	4,781	− 235
Halifax Corporation	4,431	3,503	4,970	3,910	...	4,091	4,323	4,149	4,394	...	7¼	32,382	− 131
Halifax Motor 'Buses	104	95	139	109	...	57	55	54	56	...	7¼	434	− 408
Halifax Railless Cars	...	...	...	...	...	54	61	60	62	...	7¼	446	—
Huddersfield Corporation	5,506	5,401	7,362	5,355	...	5,472	5,261	5,258	5,446	...	9	47,815	− 3,250
Ilford U.D. Council	1,541	1,567	1,832	1,573	...	1,556	1,506	1,502	1,545	...	8¼	12,361	− 250
Ipswich Corporation	736	723	849	680	...	782	784	803	883	...	8	6,616	+ 112
Isle of Thanet...	706	725	1,149	910	...	767	825	789	959	...	33½	22,060	+ 609
Kilmarnock Corporation	387	426	343	371	...	351	420	260	325	...	1½	585	− 129
Leicester Corporation	5,629	3,013	4,058	3,189	...	7,552	7,617	7,896	7,972	...	21	153,147	+ 27,211
Liverpool Corporation	24,845	24,359	27,276	26,844	...	29,445	29,731	29,688	30,604	...	21	608,484	+ 29,958
London County Council	106,210	102,288	108,651	104,052	...	94,117	97,969	95,740	99,954	...	7¼	729,185	− 64,166
Maidstone Corporation	470	403	500	420	...	468	458	450	473	...	7½	3,973	− 50
Manchester Corporation	40,370	39,410	45,167	40,967	...	37,454	37,263	35,976	36,102	...	8	300,915	− 24,765
Newcastle-on-Tyne Corporation ...	10,532	10,505	11,117	10,375	...	9,685	9,690	9,872	10,127	...	8	80,894	− 7,217
Nottingham Corporation	5,887	4,946	3,503	2,998	...	7,674	7,800	7,665	7,963	...	8	60,863	+ 15,478
Oldham Corporation	4,354	5,044	5,567	4,921	...	4,661	4,448	4,597	4,888	...	9	42,909	− 2,110
Preston Corporation	1,850	1,766	2,236	1,935	...	1,798	1,798	1,761	1,803	...	7½	133,881	− 1,143
Preston Motor 'Buses	...	...	...	...	...	132	124	125	125	...	7½	994	—
Reading Corporation	1,411	1,408	1,700	1,393	...	1,499	1,635	1,529	1,622	...	8	12,254	+ 214
Reading Motor 'Buses	334	302	498	388	...	324	340	317	351	...	8	2,642	− 39
Rotherham Corporation	2,118	1,966	2,150	2,227	...	2,117	2,117	2,065	2,119	...	7	15,026	− 214
St. Helens Corporation	1,812	1,664	2,037	1,789	...	1,520	1,602	1,607	1,599	...	8	12,046	− 1,502
Salford Corporation	10,432	11,122	14,034	10,790	...	10,715	10,603	10,807	11,113	...	8¾	87,128	− 6,306
Sheffield Corporation...	17,501	19,070	21,995	19,069	...	18,537	18,287	18,310	18,865	...	8¾	151,173	− 8,380
Southampton Corporation	2,273	2,117	2,650	2,332	...	3,029	3,203	3,038	3,279	...	8	23,618	+ 2,627
Southampton Motor 'Buses	386	392	413	431	...	101	103	100	98	...	8	782	− 1,266
Southend Corporation	1,473	1,236	2,029	1,825	...	2,159	2,257	2,233	2,396	...	8	17,640	+ 4,177
South Shields Corporation	1,405	1,412	1,675	1,610	...	1,592	1,601	1,649	1,692	...	8	13,653	+ 1,195
Sunderland Corporation	2,001	2,312	2,754	2,358	...	2,399	2,393	2,474	2,602	...	8	20,356	+ 386
Swindon Corporation	419	385	482	425	...	353	399	350	379	...	7½	2,791	− 365
Tyneside Tramways and Tramroads	1,120	1,064	1,603	1,312	...	778	814	817	884	...	21	17,044	− 8,180
Wallasey Corporation	2,584	2,420	3,123	2,762	...	2,553	2,636	2,532	2,635	...	8¼	20,966	− 1,487
Wallasey Motor 'Buses	186	273	310	291	...	229	219	240	227	...	8¼	1,856	− 110
Walsall Corporation	1,610	1,661	1,956	1,552	...	1,636	1,589	1,555	1,564	...	8	13,403	− 553
Walsall Motor 'Buses	862	848	1,297	782	...	888	855	826	789	...	8	7,400	− 303
Walthamstow U.D. Council	2,189	2,211	3,044	2,337	...	1,838	1,978	2,018	2,222	...	8¼	15,844	− 2,104
Warrington Corporation	1,066	1,016	898	803	...	980	963	923	962	...	8	7,802	− 111
West Ham Corporation	6,054	5,119	6,345	5,166	...	5,685	5,889	5,688	5,925	...	7½	45,597	− 1,159
Wolverhampton Corporation ...	2,342	2,221	3,225	2,252	...	2,024	2,136	2,025	2,125	...	8	16,992	− 1,567
Wolverhampton Motor 'Buses ...	620	600	907	665	...	611	644	613	625	...	8	5,105	− 49

Underground Electric Railways Company of London, Limited.

NAME OF COMPANY.	1921. WEEKS ENDED May 7	May 14	May 21	May 28		1922. WEEKS ENDED May 6	May 13	May 20	May 27		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Underground Rlys. & L.G.O. Co. ...	243,047	245,503	267,349	253,827	...	234,626	239,846	240,342	250,303	...	21	4,612,025	− 306,122
London and Suburban Traction ...	55,524	54,466	64,470	56,455	...	50,437	53,775	53,947	57,628	...	21	996,203	− 101,473

Colonial and Foreign Tramway Traffic Returns.

Companies Issuing Weekly Returns.

NAME OF COMPANY.	1921. WEEKS ENDED May 7	May 14	May 21	May 28		1922. WEEKS ENDED May 6	May 13	May 20	May 27		AGGREGATE. Wks.	1922.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	80,726	81,480	82,017	83,290	...	87,566	86,875	88,632	83,995	...	21	1,768,247	+ 73,153
Calcutta ... ... Rs.	86,478	84,974	82,767	79,534	...	106,407	109,399	106,621	104,075	...	21	2,231,323	+ 738,296
Madras... ... ... Rs.	(2 weeks)	51,072	...	...	...	(2 weeks)	48,663*	...	...	...	—	—	—
Pernambuco	3,593	3,437	3,515	3,541	...	3,358	3,263	3,406	3,060	...	21¼	75,268	− 15,544

Companies Issuing Monthly Statements only.

	1920. Dec.	1921. Jan.	Feb.	Mar.	April	May	1921. Dec.	1922. Jan.	Feb.	Mar.	April	May	Wks.	AGGREGATE. 1921-22.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	5,342	4,594	4,701	4,935	...	...	5,565	4,805	4,797	5,244	...	...	52	60,698	+ 3,525
Brazilian Trac. Mlrs	12600,000	12875,000	11941000	13102000	13562000	...	15405000	15032000	14473000	15238000	15413000	...	17	60,156,000	+8,676,000
Brisbane	...	46,280	43,205	46,300	47,750	...	...	48,790	43,800	51,300	48,700	...	17	192,590	+ 9,055
British Columbia $	917,668	908,385	838,682	867,083	835,793	...	940,113	907,242	821,828	849,680	818,177	...	43	8,589,842	+ 122,528
Buenos Ayres L'c'z	68,857	61,111	53,952	59,365	60,238	58,492	63,381	61,198	55,227	61,775	57,619	59,278	47	631,716	+ 9,272
Burma	50,481	50,035	48,405	50,931	50,159	...	54,194	59,362	52,380	60,296	58,631	...	39	522,054	+ 63,796
Cape Town ...	29,768	...	...	...	27,662	...	31,521	30,289	26,980	29,930	28,657	...	—	—	—
Carthagena & H. ...	5,560	3,877	2,839	2,226	2,329	1,602	3,237	3,075	2,773	2,145	2,991	2,793	21	13,777	+ 904
Cordoba	19,299	18,696	18,600	21,717	...	...	22,641	22,152	21,918	25,382	...	...	52	277,368	+ 39,922
East India ...	4,271	4,299	3,819	4,168	4,560	4,392	4,058	4,080	3,737	4,446	4,065	3,960	43	41,042	− 1,337
Kalgoorlie... ...	3,140	2,418	*316	2,485	...	...	2,814	2,180	2,031	2,390	...	...	13	6,001	+ 1,652
La Plata	...	6,506	*728	*3,403	...	...	...	6,724	6,318	7,067	...	...	13	20,109	+ 9,471
Manila ... $	315,599	321,449	306,389	298,317	279,534	...	316,467	309,252	310,001	284,576	286,044	...	17	1,189,893	− 15,816
Monte Video ...	...	50,863	48,119	48,925	46,189	46,579	...	32,634	48,111	51,158	47,960	48,074	30	327,493	− 5,963
Para	24,253	24,231	20,545	22,189	22,289	...	22,660	22,966	21,582	22,238	23,061	...	21	112,507	− 1,000
Port Elizabeth ...	8,185	...	...	...	7,082	...	8,344	8,120	6,690	7,851	6,892	...	—	—	—
Rangoon ... Rs.	120,000	122,588	120,718	158,121	...	...	145,500	137,850	130,583	150,500	...	...	13	418,933	+ 17,536
Winnipeg ... $	...	506,229	460,125	495,208	462,378	...	...	507,047	498,577	464,900	435,058	...	17	1,871,392	− 52,548

* Strike of Employees.

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GOODS
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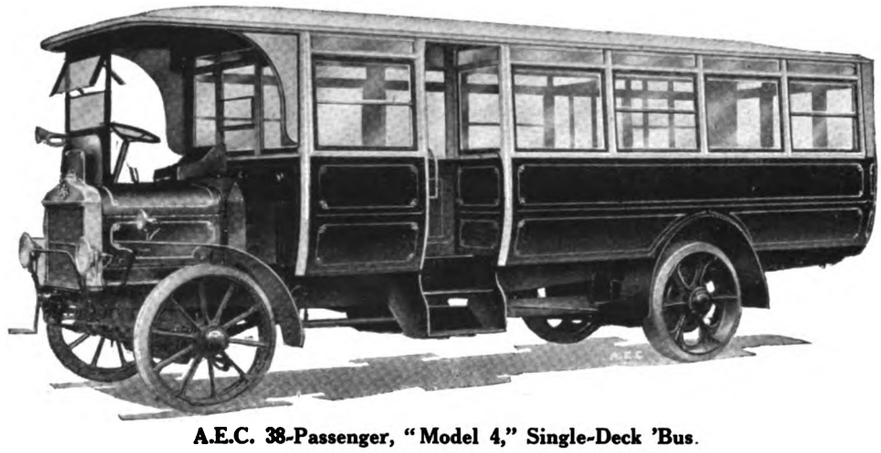

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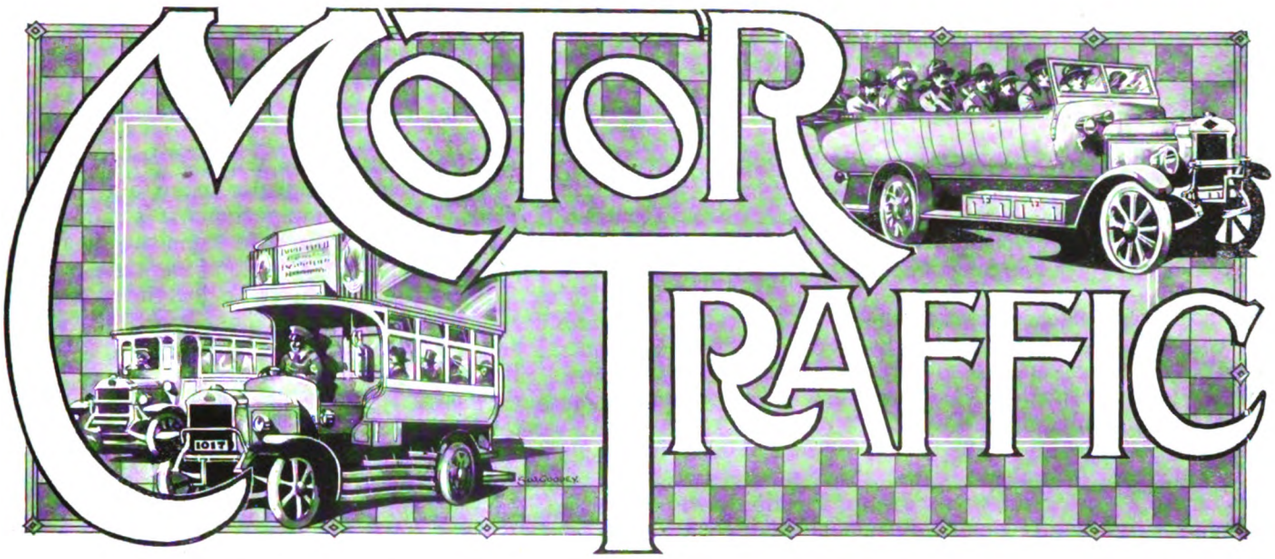

MOTOR TRAFFIC SECTION—SEVENTEENTH YEAR OF PUBLICATION.

ROAD VEHICLES OF THE FUTURE.

In the paper which he read at the recent Congress of the Institute of Transport, Sir John E. Thornycroft clearly indicated his personal belief that there will be no great changes in the nature of innovations in road vehicle design unless or until some new source of energy be discovered. He is evidently satisfied that up to the present point progress has been along the correct lines, and that the stage reached now is such that attention must for the most part be concentrated on detailed improvements. The one exception to this general view is to be found in his acknowledgment of the very great possibilities of a certain simple and well tried form of electric transmission. It would not be very surprising if in the near future we were to hear news indicating that Sir John's interest in this transmission is of a very practical character. For the rest, he is very much alive to the drawbacks of the steam as against the petrol vehicle, the awkwardness of dealing with solid fuel in any form, and the limitations of the purely electric vehicle, for which he sees little or no future. But it is probable that in his review of the position Sir John takes too little account of the possibilities of radical modification of design as the outcome of big legislative changes. He refers briefly to the possibility that, if increased loads become legal, the four-wheeled drive may grow more popular, but holds that the complication so introduced will militate against its introduction except on vehicles built to run on unmade roads or across country. This leads to the conclusion that big loads must be drawn in trailers attached to suitable tractors, but takes no account of the possible alternative of the semi-trailer type of six-wheeled vehicle, perhaps itself also drawing an independent trailer. The future of the flexible type of six-wheeler is almost entirely a matter of legal restrictions, and assuming these to be removed sufficiently and the limitation of carrying capacity to be the result of the law as to axle weights rather than as to total weights, the six-wheeler appears to have great possibilities for goods carrying work.

ENGINE POSITION.

As regards passenger vehicles, there certainly seems no likelihood of any radical change in the design of chassis, since the use of trailers of any sort is for the most part inadvisable and the weight of the load is not such as to call for the transmission of power to more than one pair of wheels. The size of the unit is not susceptible to indefinite enlargement. One of the advantages of the motor omnibus is that because its carrying capacity is limited an equally rigid limit is automatically set upon the delays occasioned by the taking up and setting down of passengers. The more commodious the vehicle the greater is the time spent in these ways, and consequently the lower is the average speed on the road. Thus, every increase in passenger capacity means a partial loss of one of the great advantages of the omnibus over the tramcar. At the same time, and despite the slight disadvantages of increasing the seating accommodation, the larger earning power which results therefrom is such as to make it obviously desirable to utilise the chassis to the fullest possible extent by placing upon it a body which can carry as many passengers as is consistent with reasonable comfort. Great strides have been made in this direction in the London omnibus during recent years, and the possibility of increasing the capacity of the unit materially without any corresponding increase in dimensions has been brought about mainly by so placing the engine as to economise the space occupied by it and the driver. Even in the very early days, the plan of placing the engine under the driver's feet instead of in front of him was tried. It was not then altogether successful, mainly because the engine itself was not sufficiently reliable, and therefore the maximum of accessibility of its parts was essential. Nowadays the omnibus engines of a well-organised company very seldom give trouble on the road, and without going so far as to place the engine under the driver's feet the alternative of putting the driver beside the engine instead of behind it may safely be adopted. This plan leaves one side of the engine quite accessible, and it is possible to arrange for all the parts that may ever need adjustment on the road to be placed on the accessible side. The comparative inaccessibility of the other side then becomes a minor matter which can be ignored if the system of supervision and maintenance is thorough. We may therefore expect to see

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MOTOR TRAFFIC

a general tendency to design engines for passenger vehicles so as to allow them to be placed in this position without disadvantage, the return being an increased passenger-carrying capacity which, in the case of a double-decked vehicle, may amount to eight persons.

WHY SOME VEHICLES ARE SHORT LIVED.

Overloading is one of the commonest causes of breakdown of commercial motor vehicles, though the effect is not always directly traceable to the cause. The evil results of overloading do not necessarily make themselves apparent immediately. For instance, in a recent example brought to the notice of the writer, an owner of a 3-ton lorry in a distant Dominion wrote triumphantly to the manufacturers stating that he had used the lorry day after day for the carriage of six ton loads, and that it had performed with absolute reliability and was apparently none the worse. He enclosed a photograph which aggravated his offence, since it showed that the type of load to which he had subjected the vehicle consisted of long balks of timber, projecting several feet forward of the radiator and half a dozen feet or more beyond the back of the tail-board. The stresses on the springs and other parts resulting from pulling such a load sharply round a corner must be terrific. No doubt the fact that the lorry survived the ordeal was good testimony to its material and stout build, but the owner will be very fortunate indeed if, in the course of time, he does not experience serious breakdowns which are really the consequence of this ill-use, even though the ill-use itself may have been discontinued. Probably when he has a bad accident while carrying only three tons, he will blame the manufacturers, forgetting that he himself is responsible as having abused the lorry in its earlier days.

OVERLOADING—OCCASIONAL OR HABITUAL.

Habitual overloading is, of course, absolutely fatal unless it is discounted by the manufacturer having assumed that it will take place. The manufacturer, of course, leaves a margin of safety as a precaution against exceptionally rough roads, slight overloading, or some unexpected shock, such as striking an obstacle, a kerb, or another vehicle. The factor of safety may be sufficient to stand a combination of unfortunate circumstances, but when the further complication of an overload is added, something has got to go. It is for this reason particularly that an occasional overload is dangerous. A single case of ill-treatment may result in a permanent injury to the metal of which some part of the machine is constructed. The fault may not be noticed, and may, in fact, be unobservable from the outside, but some time or another this fault may lead to a serious or even a fatal breakdown. One cannot cure the results of overloading by discontinuing the practice, and this is one of the reasons why the purchase of second-hand vehicles is risky.

THE SITUATION OF THE GARAGE.

To companies proposing to operate motor omnibuses or commercial vehicles in and around some large centre, the question where the garage can best be situated is a matter of importance. The most central position possible is clearly indicated as being preferable from the point of view of eliminating waste mileage. On the other hand, a site is probably cheaper in an outlying district, and this is of double importance if it is necessary in the first instance to purchase sufficient ground to leave room for considerable extensions that may be required in the future. In some instances, in fact, space for such extensions can only be obtained in a central area at an absolutely prohibitive cost. In considering the location of the garage, people are to some extent misled by the old ideas which correctly governed the similar problem as applied to horsed vehicles. It should be remembered that the elimination of waste mileage, if it can only be secured at the expense of considerable capital outlay, is less essential in the case of a fleet of motor vehicles. To the motor vehicle waste mileage covered while proceeding to the point at which useful work begins means a certain unavoidable expense, but does not reduce the useful working capacity of the machine. On the other hand, if a horse has to cover waste mileage, his useful mileage is reduced by that amount, whereas if we are operating four vehicles of about 1½-ton capacity costing perhaps a shilling a mile each to run, the necessity for covering four miles empty morning and evening means an additional cost of at the most eight shillings a day per vehicle, or 32 shillings a day in all. In actual fact the additional cost is probably less, because, for example, the amount spent on driver's wages is not increased. Thus, if the saving that can be effected in respect of garage rental, etc., amounts to something in the neighbourhood of thirty shillings a day, there is no considerable disadvantage, when accounts are balanced, in the garage located in a suburban area while, as already mentioned, the possibility of later extensions may be the determining factor in favour of such location.

REGULATION OF ROAD VEHICLES.

The Minister of Transport has appointed the following committee to consider the regulation and control of hackney vehicles in Great Britain, and the parking of road vehicles—

Sir Henry Maybury, K.C.M.G., C.B. (chairman), Director-General of Roads, Ministry of Transport.
Mr. A. G. Asher, Association of County Councils of Scotland.
Sir Thomas Berridge, K.B.E., Royal Automobile Club.
Mr. F. H. Berryman, County Councils Association.
Sir Stenson Cooke, Automobile Association and Motor Union.
Mr. F. L. D. Elliott, C.B., Police Authorities.
Sir Robert Fox, County Boroughs Association.
Mr. A. Grierson, Scottish County Burghs.
Mr. R. J. Howley, M.Inst.C.E., Provincial Char-a-banc Interests.
Mr. W. Rees Jeffreys, Society of Motor Manufacturers and Traders.
Sir Walter Nicholas, Urban District Councils Association.
Mr. F. Pick, London and Provincial Omnibus Owners' Association.
Mr. E. S. Shrapnell-Smith, C.B.E., Commercial Motor Users' Association.
Mr. C. W. Tindall, Royal Agricultural Society.
Mr. Seymour Williams, Rural District Councils Association.
A representative of the Ministry of Health.

The terms of reference are as follows—

(1) To consider existing legislation and practice in connection with the use, construction and regulation of road vehicles (other than tramcars and trolley vehicles) employed for the purpose of carrying passengers for reward and to report thereon; (2) to consider and report as to what, if any, powers it is desirable should be conferred on local, police, or other authorities to make arrangements for and/or to require road vehicles to be parked either on public highways or elsewhere in the interests of the owners or drivers of such vehicles, and with a view to the reduction of traffic congestion.

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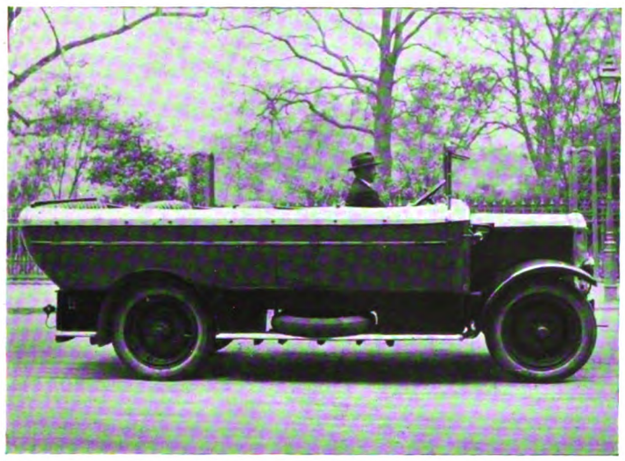
MOTOR TRAFFIC

A NEW KARRIER MODEL.

For several years, prior to 1914, Karrier models included types designed for loads of 30 cwts. and 2 tons, and many of these vehicles are still giving useful service. On the outbreak of war, however, the whole of the company's efforts were concentrated upon the production of W.D. models for the army, and the manufacture of the smaller models ceased. Under these circumstances it is not surprising that the firm has now added a 30–40-cwt. model to the



Karrier 14-Seat Motor Coach.

excellent range of heavy-type vehicles for which they have become so well known. The new model, known as type C, is the result of careful consideration of the requirements of users of this particular class of vehicle, and has now been placed upon the market after a series of tests which have thoroughly demonstrated its capabilities to fill efficiently these requirements. In general design the new type differs considerably from the larger Karrier models, but the characteristics of sturdy construction and simplicity of layout are maintained, while it is expected fully to uphold the firm's traditions with regard to reliability and low maintenance costs.

The new model is standardised in two types, one for net loads of 30 cwts., and the other for 2 tons. In the accompanying illustrations the latter type is shown fitted with a motor coach body, with pneumatic tyres and arranged to seat 14 passengers. This is a size of vehicle which bids fair to have a very successful future, as by its handiness, comfort, and speed, it has already won much favour on its trial runs. The standard equipment of this coach, which has been built entirely at the firm's works at Huddersfield, includes the Karrier patent one-man hood, which when not in use folds away into a longitudinal box on the off-side of the body. The hood can be erected by one man in less than a minute and is folded away with equal speed and ease. The advantages of concealing the hood are many, chief amongst them being that a particularly good appearance is imparted to the lines of the body, while being enclosed in a water-tight compartment the hood is kept free from dust and wet.

The following is a brief description of the chassis—

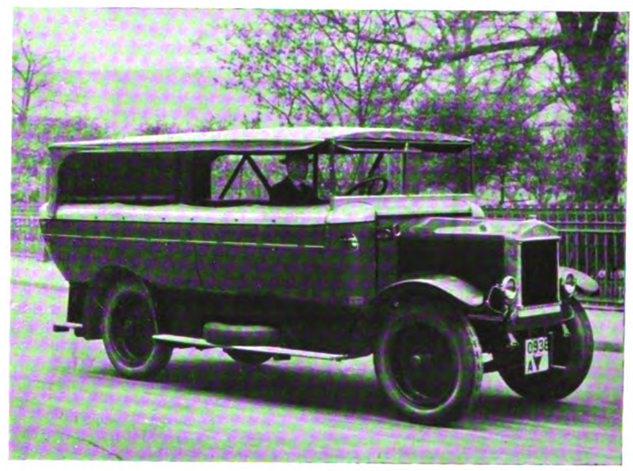
The engine is a four-cylinder monobloc type of Dorman manufacture, 95 mm. bore and 140 mm. stroke, developing 25 H.P. at 1,000 revolutions. Apart from the generous water jacketing, especially around the valve pockets where most heat is generated, there is a big margin of safety in the extra long bearings on which the crankshaft and camshaft are mounted. The most noticeable feature of the power unit is, however, the cleanness of design and the accessible position of the various units that call for periodical attention. A long inspection door, removable by undoing two handscrews, provides access to the valve mechanism, and the exhaust manifold can be withdrawn by removing two bridge pieces each held by a couple of nuts. On the offside the dynamo driven by whittle belt is placed well forward. Immediately behind it in the case of the pneumatic-tyred motor coach is a mechanical tyre pump, and behind that again is the B.T.H. magneto, the coupling of which provides a positive drive with a fine means of adjustment. The carburetter is a Zenith, easily accessible, and below it is the oil filter which can be detached for cleaning by simply unscrewing a couple of studs. Lubrication is forced by pump to all main bearings, and a simple type of tell-tale indicator is fitted on the dash, where it is within easy view and reach of the driver, so that he can always tell whether the system is operating properly.

The cooling water is circulated by pump, and a four-blade fan, driven by belt from the dynamo, is provided behind the large surfaced gilled tube radiator. The whole engine and the gear box, although separate units, are carried on a sub-frame anchored at four points and substantially supported in the middle.

The clutch is of the cone type, Ferrodo lined, with suitable means of adjustment, and the entire mechanism is exposed by lifting the front metal-covered floor boards. The gear box is a one-piece casting and affords three speeds and reverse, the forward speeds at normal engine revolutions giving a rate of $5\frac{1}{4}$, 12, and $18\frac{3}{4}$ miles an hour respectively, in the case of the commercial model, and a top speed of 20 miles an hour in the case of the passenger type. The shafts and gears are of the best quality nickel chrome steel, accurately ground to ensure easy engagement, and mounted throughout on ball bearings. Central control of the ball type with a gate device is provided, and both gear and brake levers are placed close up to the driver where they do not interfere with the front seat passengers. An easily removable filler cap is fitted on the top of the gear box. The batteries are enclosed in a wooden box placed on the driver's right, where it is protected from the weather.

Behind the gear box is the foot brake, which is of the metal to metal external contracting type, and the hand brake, which is of the internal expanding sort, operates on back-wheel drums. In both cases the adjustment is by large handscrews, the transmission brake being reached from above, and the rear brake mechanism from the side of the chassis. An open propeller shaft transmits the power to an overhead worm-driven back axle, and a couple of Hardy universal joints are used. A capacious filler is fitted at the back of the differential, and the removal of a large cover enables the whole mechanism to be withdrawn.

The road wheels are of the pressed steel disc type, with floating phosphor-bronze brushes, and by removing six bolts, the wheel and axle shaft can be withdrawn. The tyres fitted in front are 90 mm. by 720 mm., and 120 mm. by 720 mm. at the rear. The hubs are so designed that pneumatic tyres can be fitted throughout, if required. Semi-elliptic springs of good length are used, and these, in conjunction with the pneumatic tyres on the passenger model give a fine



Karrier Motor Coach with Patent Hood.

degree of comfort. The steering is of the worm and sector type. The swivel pins are fitted with large oil cups, so that when once filled they require no further attention until replenishment is necessary. The oilers are provided with screw caps held by chains.

The wheel base measures 11 ft. and the track 4 ft. 8 in. An important feature of the chassis which makes for simplicity is the use throughout of Enots greasers, with the exception of a single ordinary greaser on the clutch spigot.

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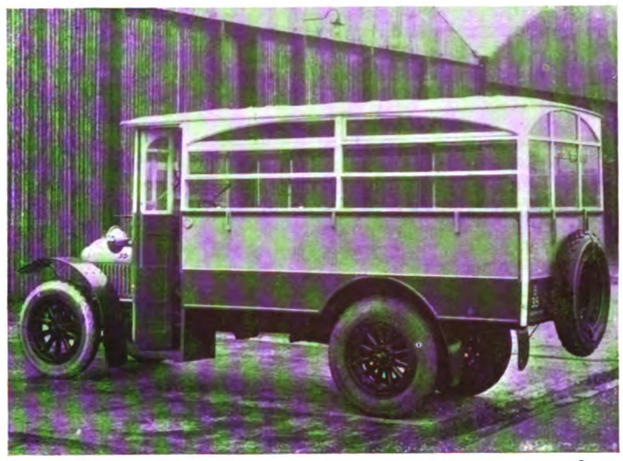
MOTOR TRAFFIC

"NORFOLK" LIGHT OMNIBUSES.

A One Man-operated Body made in East Anglia.

Judging by the experience of the United Automobile Services, Limited, of Lowestoft, there is a great future for the small omnibus running on either pneumatic or solid tyres. This type has proved popular in the Norfolk and Suffolk services. The public appreciate it because of comfortable riding, not only on account of the pneumatic tyres used with a light vehicle, but because the special construction of the body eliminates dust from the interior. By the operating company its use is advocated for several reasons. First, there is the higher speed and more frequent services. In the second place there is the economy of operation due to one man acting as driver and conductor, to the saving of fuel both with pneumatic and solid tyres, to the decreased cost of the annual licence, and to the absence of accidents to passengers.



"Norfolk" Body for Light Chassis.

The "Norfolk" body is made in four sizes, giving accommodation to 14, 26, 30 and 34 passengers respectively. The illustration given above depicts a 14-seat body mounted on a one-ton chassis, but any other suitable chassis can be utilised. In the United States the light omnibus on pneumatic tyres predominates, and consideration of the experience of the United Automobile Services, Limited, indicates that there is a wide field for its extended use in this country. The company claim that the 26-seat body (with 8 overload if necessary) is quite sufficient capacity for all except densely populated town routes. Based on a double shift of conductors, with weekly wage of £3 10s., the "Norfolk" body operated by one man is claimed to effect an annual saving in wages of £364. The saving in petrol with pneumatic tyres is given as £133 over the standard heavy vehicle, and with solid tyres £83. The basis of calculation is 6 miles per gallon for the heavy omnibus, 10 miles per gallon for the lighter vehicle on pneumatic tyres, with spirit at 1s. 11d. per gallon, and an annual mileage of 20,000. In taxation there is a saving of £22 for the 26-seat machine. A further contention is that a pneumatic tyred omnibus is approximately 50 per cent. faster than one with solid tyres, thus enabling the earnings to be increased, and rendering it possible for two such vehicles to replace three of the heavier cars, while if the same number of "Norfolk" omnibuses are used, a more frequent service can be maintained. On repairs it is estimated that the latter effect a saving of 1½d. per mile, running at a speed of about 16 miles an hour, compared with about 11 miles per hour of the heavier units.

A glance at the illustration will show the advantage of what is justly termed the safety door. To the entrance and exit by the side of the driver there is a door that closes over the outer step, which is close to the ground. The driver shuts the door before starting, and does not open it until the omnibus has stopped. By this procedure he prevents the most frequent cause of accidents, due to persons boarding or leaving a vehicle in motion.

The prices of the four sizes of body range from £200 to £400. The bodies are built in the company's coach building factory at Lowestoft under the most approved conditions of quantity production.

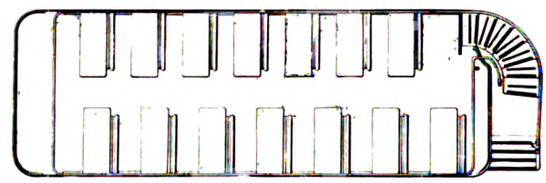
THE DODSON DOUBLE-DECK BODY.

Commodious Seats, Wider Gangway, and Better Ventilation.

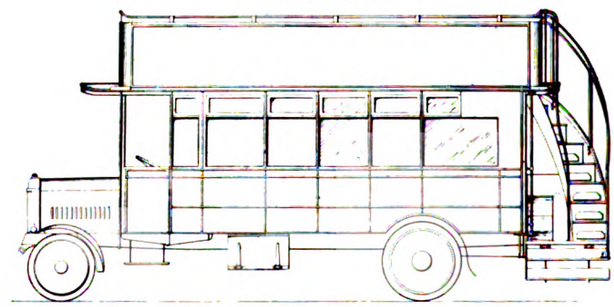
With praiseworthy results, Messrs. Christopher Dodson, Limited, of Willesden, N.W.10, recently set themselves to remedy shortcomings in the interior width of double-deck omnibus bodies which have to comply with the outside dimensions permitted in the Metropolitan area. The first batch of the improved bodies has been delivered, mounted on Dennis coach type chassis, to the Westcliff-on Sea Motor Services, and opinion in that locality appears to be that the new superstructure constitutes a great advance in omnibus construction. From the accompanying photographs a clear impression will be gained of the interior and exterior of this body. Details of the dimensions will be gathered from the drawing showing the general arrangement.

As builders of bodies to a number of leading manufacturers of public passenger vehicles, Messrs. Dodson have, of course, carried out various designs supplied by their customers. Consequently the firm is well aware of the deficiencies revealed in some cases when the machines have been put into service. In seeking to provide a remedy, Messrs. Dodson have, therefore, benefited not only the public but the operating companies.

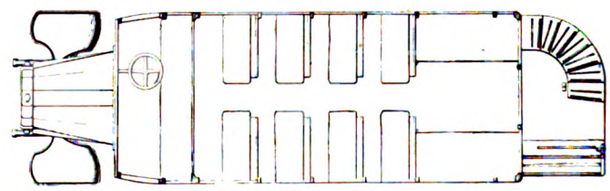
The specific intention underlying the CD22 design, as already mentioned, is to obtain greater width inside without exceeding the present permissible width in the London police area of 7 ft. 2 in. It is common knowledge that the interior cross seats of the London omnibuses could, with great advantage, be increased in length, a freer gangway being also very desirable. The builders seem to have made a distinct advance in this direction. They dispose each of the side pillars of the body framework immediately behind the interior chair backs. The importance of this will be recognised when it is pointed out that in this position the pillars can be of any required cross-section without interfering or encroaching upon the interior room. Another innovation is that the panels are not flush with the pillars, but are placed immediately on to the waist rail in between the pillars. The result is seen in the provision of an increased interior width of 3 in., over and above that in the usual conventional construction. This improvement enables the length of each of the cross seats to be increased by 1½ in., and considerably more freedom is noticeable in the gangway when all seats are occupied. This special feature of the body, the builders inform us, they have protected.



Plan of Top Deck.



Side Elevation.



Plan of Lower Deck.

Dodson Double-Deck Body.

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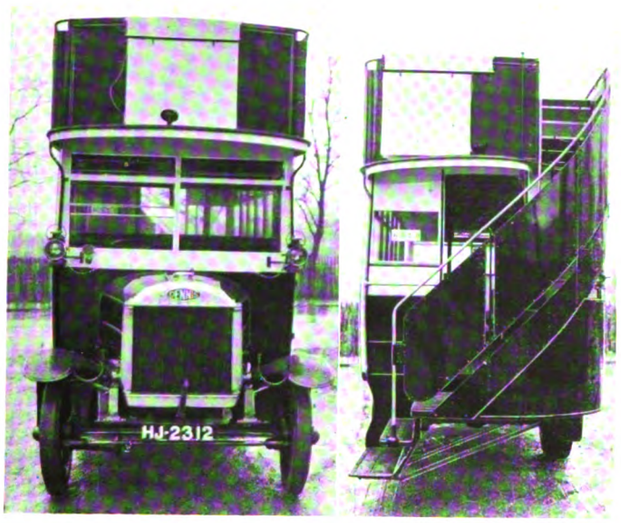
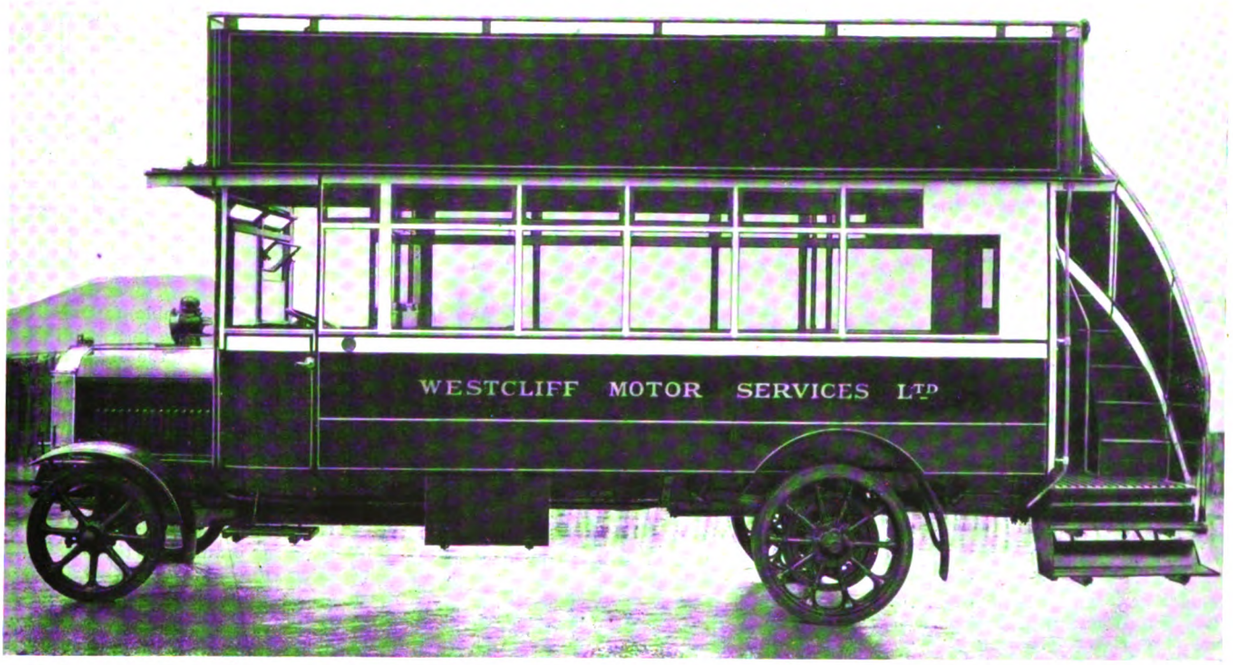
Another interesting feature of the omnibus is the ventilating arrangements. Each of the ventilators above the side windows open at the fore-end. This arrangement is not new, as several omnibus and tramway undertakings at present have incorporated this feature, but owing to the eaves of the roof overhanging only by



Front and End Views of Dodson Double-Deck Body.

about 1½ in., with this type of ventilator, rain would enter the body unless special provision was made to prevent it. Messrs. Dodson bring the side screen boards right down on to the roof, leaving no gap whatever. On the roof and up the boards they fit a light metal gutter. Down-pipes are provided at the fore-end, and one at the near rear corner, the latter also functioning as a grab handle.

Another feature is the elimination of top roof irons, which are usually fitted to carry the screen boards and top rails. The supports for the top rails are integral with the screen board framing. The supports are of hard wood, grooved out on the top to carry the rail which is fixed to them by a light metal clip. The omnibuses now running at Westcliff may be claimed as a great advance in body construction.



The Dodson Double-Deck Omnibus Body.

BIRMINGHAM AND MIDLAND OMNIBUSES.

Successful Year, but Railway Competition Reviving.

Mr. R. J. Howley, C.B.E., chairman and managing director, at the 17th annual meeting of the Birmingham and Midland Omnibus Company, Limited, on May 24, stated that the net receipts amounted to £103,095, compared with £81,892 for 1920. The increase had been brought about by the larger volume of passenger receipts, due largely to the extension of the services. The increased traffic revenue, he was glad to say, had been earned with a smaller percentage of expenditure to receipts than was the case in the previous year. The price of petrol, of which they used large quantities, fell during the year, and it was possible to effect some reduction in the rate of wages paid. Income-tax had decreased from £7,445 to £2,340 owing to the larger amount recovered on the payment of increased dividends. The balance sheet showed a strong position in regard to cash and investments. A sum of £25,000 had been placed to reserve, bringing the total of that account to £75,000. The amount available for distribution was £90,343, as compared with £59,812. They were paying 10 per cent. on the ordinary shares, with a bonus of 5 per cent., and carrying forward £22,170. During the first part of 1921 the traffic receipts showed continued expansion, but during the summer and autumn a great change took place, and private hire work especially showed a considerable falling off. The reduced spending power of the public, and the competition of cheap week-end and market tickets on the railways were becoming apparent in the passenger receipts. The decrease in receipts was being met to a very large extent by reduced cost of operation, and the prospects of the company for the current year were, so far, not unsatisfactory. In view of the uncertainty of the future the directors considered it better not to increase the dividend on the ordinary shares, but to distribute a bonus in respect of the results of the past year. Capital expenditure had been kept down to as great an extent as possible. The long-distance services were well patronised. They had in Mr. Power, the traffic manager, and Mr. Shire, the engineer, two officers to whom was due more than to anyone else the continued prosperity of the company.

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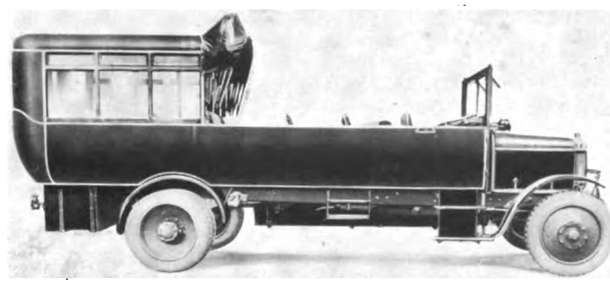
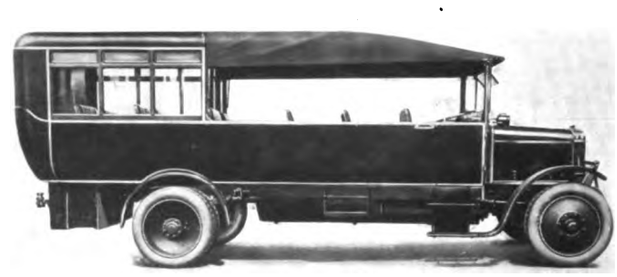
NEW TYPE ALL-WEATHER COACH.

NOVEL DESIGN BY COMMERCIAL CARS LIMITED.

A new type of " all-weather " coach, possessing several interesting features, has been built by Commercial Cars, Limited, of Luton. The vehicle is divided into two portions, as will be seen from the accompanying illustrations. That in the rear is permanently covered in, and accommodates 13 passengers. It is fitted with frameless windows of ¼-in. plate-glass both along the sides and in front. All the windows drop down level with the fence rail, making the interior quite open when necessary. Three ventilators are arranged along each side, above the drop windows. The open portion of the body accommodates 16 passengers. There are two doors on the off side—one at the front giving access to the first three rows of seats and the other by the fourth row, admitting to the covered-in portion. A door for the driver is located on the near side. With all the windows down the vehicle is, to all intents and purposes, an open one.



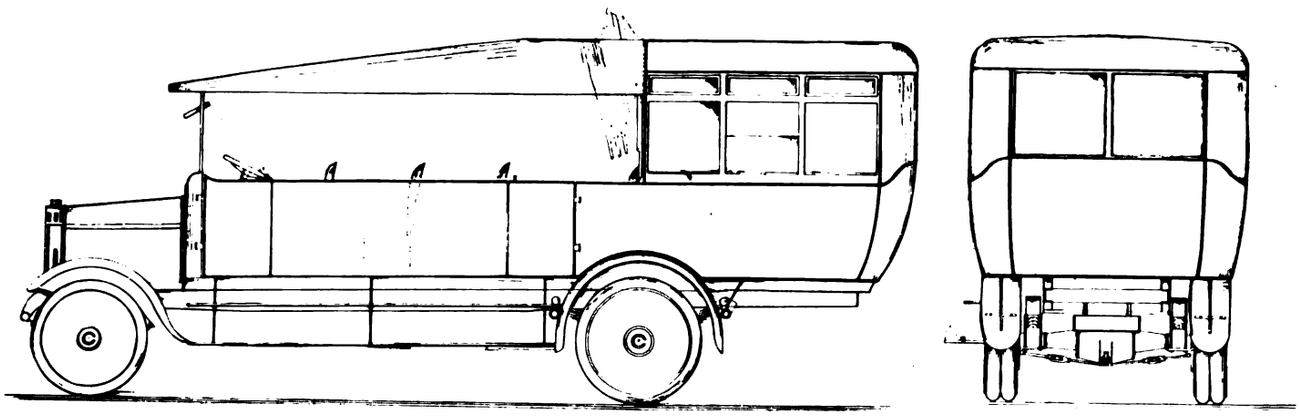
All-Weather Coach with Hood.

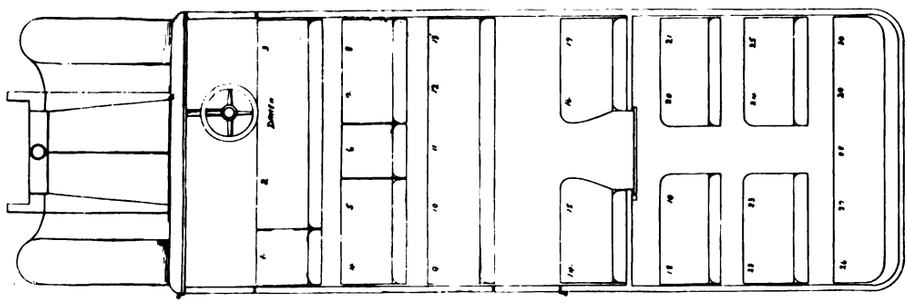


All-Weather Coach with Hood Extended.

The seats are arranged in pairs, each having arm rests, to take two persons. There is a gangway down the centre, and the back seat, which is of the full body width, takes five persons. The whole of the seats are upholstered in best black leather. They have very comfortable spring cases, and the backs have pleated squabs. Gangway seats with special folding backs are fitted to the driver's seat and the second seat. The floor of the saloon is raised 2 in. above the floor of the front portion, and the height of the saloon from floor to roof is 5 ft. 8½ in. Electric lights are fitted in the roof.

Passengers in the open portion are protected from bad weather by a patent cantilever folding hood of black waterproof twill, which when not in use folds back to the permanent portion, and in no way obscures the view. Another feature of this hood is the absence of hood sticks requiring attachment to the sides of the coach when the hood is open. By drawing this hood across, putting up the side curtains (which have celluloid lights), and closing the windows, the vehicle can be totally enclosed with very little trouble. The chassis is the " Commer " 3P passenger type, with interchangeable disc wheels and twin pneumatic tyres on the rear and singles on the front. The wind-screen extends the full width of the body, and the portion opposite the driver is made to open.





Plan and Elevation of All-Weather Coach—Commercial Cars, Ltd.

One noticeable feature is the double running board on the near side between the front and rear wings. The lower footboard, while loading is in progress, is double the width of the upper one, so that passengers are in fact negotiating stairs instead of the usual ladder. When the vehicle is about to proceed the lower footboard, the outer portion of which is hinged, is folded over inwards to the same width as the one above. This refinement is particularly useful in muddy weather, as it ensures a clean landing step. The bottom framing is of well-seasoned English oak, and the pillars are of English ash. Steel plates form the outside panels, while the inside is panelled in three-ply birch. The body is painted royal blue, both inside and outside, with mouldings lined yellow. The ceiling of the saloon is enamelled. A large box is fixed at the rear for carrying suitcases, and a petrol carrier, to hold three tins, is installed on the off side. Dome wings are fitted back and front.

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FUTURE DESIGN OF ROAD VEHICLES
FOR GOODS AND PASSENGERS.

Sir John E. Thornycroft, K.B.E., presented a paper on this subject at the London Congress of the Institute of Transport on May 18. Referring to the present method of taxation he said—"Its effect, as regards the pleasure motor car, is already apparent and most unfortunate. Taxation on the cylinder diameter has resulted in producing cars with motors having cylinders of very small dimensions and running at very high speeds which, while they may have limited vogue in this country, will have little, if any, sale in overseas markets where vehicles with larger, slower running engines are much preferred. The large commercial vehicles are now taxed by the weight and there is really no reason why cars should not be taxed in the same way also. There is nothing impossible about it, as it is the practice in a number of the colonies."

After alluding to steam, petrol and electric battery vehicles, Sir John said—"There is a fourth type which it seems hardly fair to look upon as a self-propelled vehicle in the ordinary sense. I refer to an electrically-driven vehicle, taking its source of power from an overhead conductor in the same way that a tramcar does. It seems improbable that a vehicle driven in this way will ever come into general use for carrying goods but, for passenger work, it is probable that there will be a very considerable development owing to the vehicles combining the advantage of obtaining their power direct from a central power station, which must necessarily be much more economical than power generated by small individual motors, and having the freedom of an independent vehicle to move anywhere in the road as long as there are electric conductors."

The author then considered in detail the efforts that are being made by designers of different types of vehicles to improve efficiency. Dealing with steam vehicles, he stated that with neither of the two well-defined types is any attempt made to condense the steam and the large quantity of water which is necessarily carried not only adds to the weight of the vehicle but is often difficult to obtain. It would be generally agreed that the designers had probably done as much as was possible with a non-condensing vehicle of this type. One of the earliest designers of steam vehicles, Mr. T. Clarkson, was, however, still working with a view to improving the type and had produced a very interesting design.

Discussing electric vehicles, Sir John remarked that electro motors are so far standardised that one can only look to improvements in storage batteries to make any great change in their carrying capacity and radius of action. Dealing with petrol vehicles, he pointed out that the design "which has been generally adopted, as the result of practical experience, is that consisting of an internal combustion engine on the front of the vehicle placed over a steering axle, a disconnecting clutch and a change speed gear of the simplest possible form, namely, a driving and driven shaft with gears of different ratios which can be slid in and out of mesh, the power being transmitted to the driving axle by a shaft operating a worm gear on the axle or by means of bevel drive. Chain gear is still employed in some cases, but it is certain that it is being displaced by gear transmission.

"In considering the chances there are of any radical change one would ask, is it probable with increasing loads that builders will adopt a drive on all four wheels? Where vehicles are intended to run on made roads, in the writer's opinion, the complication of driving on more than one pair of wheels would always be a bar to the adoption of the system. For vehicles to run on unmade roads or across country, a four-wheel drive has great advantages, but it is probable that, for these conditions it will be more economical to use an ordinary lorry drawn by a special tractor. If we assume that the vehicle will continue to be driven by one axle, what are the most likely features to be modified? Running costs are largely made up of fuel consumption and maintenance. It is a very nice point for the designer so to proportion the parts of his mechanism that he does not make the size of the various parts of the mechanism so large, to reduce the stress and wear, that he unduly increases the weight of his machine and its consumption of fuel.

"The only alternative to the gear box transmission, which is meeting with any success for commercial vehicles, seems to be the Stevens' electric drive consisting of a continuous current generator driven direct from the motor and which, in turn, drives the axle by means of an electro motor coupled to it by a propeller shaft or other means. While the inevitable shock, which is often very small, of engaging the clutch and gear in the ordinary system is avoided and a very sweet drive obtained, the efficiency of the electric transmission is necessarily less than that of gearing and a considerable additional weight is added to the vehicle. How far these are balanced by reduction in wear and tear is a matter for experience, but the designers of the system contend that there is an advantage on the side of the electric transmission."

Referring to the advantage which designers now have of using greatly improved material, the author said there is a possibility of employing aluminium to a greater extent owing to improvements in its alloys. "The extent to which its employment will increase will no doubt depend to a great extent on the price at which it will be produced in comparison with cast iron and steel. Coupled to some extent with the employment of aluminium for various parts of the lorry will be, it is thought, the use of pneumatic instead of solid rubber tyres. The relative advantages of solid *versus* pneumatic tyres are difficult to decide. For passenger vehicles and lorries taking fairly heavy loads, with the present cost of pneumatic tyres it seems very doubtful if they are worth while except in certain special cases. For the heavier loads, the pressures required in the tyres are so great that the shocks to the road do not seem to be very much less. While designers of the chassis have been doing their best to save weight, with the exception of the London General Omnibus Company and a few others, little has been done to improve the construction of the body work of passenger or goods vehicles. When goods are carried on a plain lorry platform, the weight is a small proportion of the load, but, in the case of a high-sided or box van, it becomes quite a large proportion. The weight of the containers now used by large carriers and railway companies is often a very large proportion of the load, and to obtain really economical results with this system considerable improvement must be made. There is a tendency to give less space in the front of the vehicle to the motor and there is every probability of the arrangement, in which the driver is placed alongside the motor instead of behind it, being further developed."

The writer did not think it probable that there would be any great change in the design of present-day road vehicles, and engineers would have to content themselves with devoting attention to improving details of design with a view to getting the best possible economy out of the fuel available and making the machines as simple as possible to maintain.

THE DISCUSSION.

Mr. R. J. HOWLEY, in opening the discussion, suggested that the reason why the steam vehicle continued in favour was because it was economical to run on account of the comparatively cheap form of fuel. The cost per ton-mile to-day was about one-third of that of petrol. All who were concerned in mechanical road transport should appreciate the work Mr. Clarkson had done in developing the steam vehicle. Users of petrol vehicles were depending, unfortunately, on imported fuel, and every encouragement should be given to such men as Mr. Clarkson and others who were evolving a type of vehicle which required fuel that could be produced in this country. He had no doubt that as time went on there would be developments in carburisation and pre-heating of fuel which might result in the satisfactory use of a cheaper form of fuel. Discussing the railless trolley vehicle as a possible substitute for tramways, Mr. Howley said that where the traffic on a tramway route did not justify the relaying of track, he thought the railless vehicle had a future. On long routes, however, it would generally be found that the purchase price and cost of upkeep of the overhead system—not only the wires but the feeding cables—rather detracted from the railless system, from a commercial point of view. There did not seem much prospect, for some time to come, of any big developments other than along the lines of the petrol chassis. Anyone who travelled in a large omnibus must know that the clutch was not yet satisfactory. For starting or for changing speed with a heavy load, the clutch as it existed to-day was, in his opinion, a rough and uncouth piece of mechanism. There was no doubt that even in its present form it could be greatly improved.

Mr. A. Dryland (county surveyor of Middlesex) said the vehicle which damaged the roads also damaged itself, and therefore he believed that the vehicle designer would in future pay more attention to the question of shocks, their distribution and absorption. Relief might be obtained for the roads by the reduction of unsprung weight or the complete springing of vehicles by more resilient tyres, preferably of the cushion or pneumatic type. Anything which manufacturers could do to improve their vehicles would help the road authorities very much, besides helping themselves.

Mr. NEVILLE (managing director of Messrs. Whitbread, brewers)

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said the problem of determining the relative cost of transport with each class of road vehicle depended not so much on the economy of the vehicle itself but on the cost of loading and unloading and of standing still in traffic.

Mr. G. J. SHAVE (chief engineer and operating manager of the London General Omnibus Company) believed that there is a great future for the producer-gas system used on commercial vehicles. This method was not, however, desirable for omnibuses, as the driver should be given as little as possible to do besides driving the vehicle and watching the road. The producer-gas plant would give him a little more to do than could be allowed. He considered it would be many years before they could devise anything better adapted for passenger-carrying than the petrol driven chassis. A good deal of research work could well be directed towards affording a smoother type of transmission. As regarded the alleged inefficiency of the clutch, Mr. Shave mentioned that his company were using a multiple plate clutch. Unsprung weight was a very serious proposition and they should do everything to bring it down to a minimum. The tyre was the first item that should be tackled. The pneumatic was not yet anywhere near general adoption for the heavy vehicle, but they were very near to the adoption of a more resilient cushion tyre, with aluminium wheels, for such vehicles. Alluding to the trolley omnibus, Mr. Shave favoured its use only where the necessary electrical equipment was in being, and described as foolish and unprofitable the installation of a central station and overhead equipment for the purpose of running a service.

LORD MONTAGU OF BEAULIEU said there must be more co-operation between the roadmaker and the designer of motor vehicles. The design of the latter would eventually follow the same trend as the railway vehicle; in order to relieve the wear of the road we must put the strain on more than four wheels. Discussing future methods of motive power, Lord Montagu confessed himself a firm believer in the gas suction plant for many purposes for which petrol was used to-day. He also expressed the opinion that the present system of taxation of motor vehicles was very bad.

Mr. F. CHURCHILL (chairman of the Commercial Motor Vehicle Section of the Society of Motor Manufacturers and Traders) said from the road point of view he did not see any advantage in a six-wheeled vehicle, as the maker would put the maximum permissible load on each wheel. The basis of motor taxation was wrong, as at present ownership was taxed, however seldom the owner might use the vehicle. Taxation should be by weight in conjunction with the extent of the user.

Mr. SIDNEY E. GARCKE said that for passsenger work, as compared with goods, what was needed was better springing, easier starting and braking. For passenger work we could not make a vehicle of much greater length than the present ones without recourse to six wheels—which would surely come in the end.

Mr. A. L. C. FELL (general manager of the London County Council Tramways) said the ordinary road authority got back from taxation some of the increased cost of providing the permanent way for ordinary motor vehicles. Tramway authorities got nothing, and their interest that morning was to find out in what direction manufacturers were improving their motor vehicles so as to lighten the wear on the roads. He had heard no suggestion that the weight would be decreased. It might be that the designer of the latest passenger vehicle was reducing weight per seat, but that was in order to put on a larger load. They had been enjoined from youth to bear one another's burdens, but no one seemed disposed to bear the tramwaymen's burden. (Laughter.) In a reference to the trolley omnibus, Mr. Fell favoured a suggestion for a combination of the tramway and the railless vehicle and said that if the power station and overhead system already existed, it was quite an easy matter to arrange a connection with small outlying districts in order to test the traffic. The taxation of motor vehicles was on an entirely wrong basis and he hoped some drastic action would be taken. "I am a tramway optimist," continued Mr. Fell, "but I realise the enormous developments which have taken place in connection with motor vehicles during the past ten or fifteen years. At the same time I am certain no useful development will ensue until the Government take action to put all these things on a proper basis throughout the country. At present we are tumbling over one another and there is an enormous amount of unnecessary competition. If the Government take a firm hand with the whole situation, we should get the whole of the vehicles used to the best advantage and most economically in our own particular spheres."

Others who took part in the discussion included Lt.-Col. J. Nall, Mr. Carr Thomas, Mr. Frank Pick, Mr. Norman Box (Manchester), Major Strictland, Major T. G. Tulloch, Col. Sinnott, Major E. A Beaumont and Mr. W. Worby Beaumont, who, in proposing a vote of thanks to Sir John Thornycroft, recalled the important work he has done for the industry.

The CHAIRMAN (Mr. E. S. Shrapnel-Smith, C.B.E.) seconded the vote of thanks, and made passing allusion to the development of power alcohol. When one noticed the encouragement given in France and Germany to the production of this, he said, it was a good thing to see our own Government offering a subsidy of 5d. per proof gallon for every gallon produced in this country. It was also encouraging to reflect that the great distilling interests were devoting much time to developments along these lines and that good results were being obtained on our roads with power alcohol, combined with benzol and paraffin. The taxation question must remain thorny, but people who talked of taxation solely in relation to use were far from understanding the necessary lines of enquiry. Use was only one factor, and it was necessary to have regard to the purpose of use. In a personal reference to Sir John Thornycroft, the chairman said that since 1897 no man in the industry had worked harder and more consistently with brain or hands than he.

A VISIT TO DENNIS BROTHERS' WORKS.

At the conclusion of the Transport Congress on May 20 a very enjoyable and interesting visit was paid to Messrs. Dennis Brothers' Works at Guildford. Two handsome coaches took the party out from London and a halt was made by a large mere adjoining the Portsmouth Road, where several of the company's motor fire appliances were giving a demonstration. One machine which attracted much attention was a 200-250 gallon patent turbine hand or trailer-drawn motor fire engine. This is a very handy little equipment on two wheels, especially suitable for small brigades. One of the firm's larger machines, which have been so generally adopted throughout the country and abroad, was also seen "in action," as was a specimen of their street watering and washing machines. Sir Raymond Dennis met the party at Guildford and conducted them over the fine modern offices and works. One was particularly struck with the efficient organisation of the huge plant, the pleasant conditions under which the whole of the employees work, and the provision made for their comfort and recreation. Several Dennis motor vehicles were shown on test ascending a hill near the town, with a gradient of one in six. All the models took the slope without difficulty, including a lorry with a 5-ton load and a 750 gallon water tank, with pump.

Luncheon was served at the White Lion Hotel. Sir Raymond Dennis presided and apologised for the absence of his brother, the senior managing director, who was unable to attend. The chairman extended to the party a hearty welcome to Guildford, whose principal industry was the output of Dennis motor vehicles. It had given him great pleasure to show the guests over the factory and to enable them to see the demonstration of the different vehicles.

In a passing reference to the company's new street washing machine, the chairman mentioned that it was intended to supplant the practice of washing thoroughfares with a hose. Another municipal machine for emptying cesspools and gullies had, according to one purchaser, effected a saving compared with horse appliances, of £481 in eight months. Turning to motor fire engines, Sir Raymond said their models were now being used in many of the principal cities of England and throughout the world. There were over 100 used in London alone. The prosperity of the firm in general was evidenced by the fact that their shares had been higher than those of anyone else in the industry, and they were continuing to pay—which was very unusual—a handsome dividend to the shareholders.

Mr. T. W. A. HAYWOOD proposed "Health and Prosperity to Dennis Brothers," coupled with the name of Sir Raymond Dennis, and the toast was enthusiastically honoured. Mr. W. E. Hobbs, O.B.E. (publicity manager) submitted "The Institute of Transport," referred to its remarkable growth, and coupled with it "The Institution of Municipal and County Engineers."

Mr. E. S. SHRAPNELL-SMITH (a vice-president of the Institute of Transport), in response, alluded to the pioneer work done by Messrs. Dennis Brothers. Mr. Norman Scorgie (president of the Institution of Municipal and County Engineers) gave "The Chairman," and referred to the interest and educational value of the day's visit. In no small measure was the success of the firm due to the efforts of Sir Raymond and his brother.

[A report of other proceedings of the Congress appears elsewhere in this issue.]

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MOTOR TRAFFIC

MOTOR AND ROAD PROBLEMS.

NEW INQUIRY BY THE MINISTRY OF TRANSPORT.

At the first annual conference of the National Federation of Hackney Carriage Proprietors, held on May 23 in London, Mr. Dunn, of Liverpool (president), said they had met to consider such questions as the horse-power tax and the import duties on motor parts. They could not procure these parts in England, and they considered it a hardship to have to pay 33⅓ duty on them. There were 20,000 owner-drivers of motor cabs.

Mr. Arthur Neal, Parliamentary Secretary of the Ministry of Transport, remarked that all he could say about matters of taxation was that there was an agitation arising from exactly the opposite point of view. This found expression in the House of Lords the previous week, and it was to the effect that motor owners were not paying enough towards the upkeep of the roads. Local authorities looked with dismay on the present cost of upkeep. Motor owners looked with dismay on the present cost of taxation, but ignored the fact that it did not impose a heavier burden than the petrol tax for which it was a substitute. The Government had set up a Committee to investigate whether there was a fairer way of securing the revenue necessary.

DISCUSSION IN THE HOUSE OF LORDS.

On May 18, in the House of Lords, Lord Harris moved a resolution that the user of roads, both those which as regards width are not suitable as well as those which are suitable for heavy motor vehicles, has become so great, and the financial burden thrown on ratepayers in rural parishes owing to the increased cost of making roads sufficiently strong for such heavy vehicles has become so serious, that the subject is deserving of inquiry by a Committee of Parliament.

Viscount Long, supporting the motion, emphasised the demand for an inquiry by a Parliamentary Committee and not by a Departmental Committee. He did not want to stop coach traffic to the seaside, but he wanted it to be regularised, and wanted to be satisfied that those who used the roads in this way paid their full share of the expense.

Lord Montagu agreed that the present system of road maintenance could not go on much longer.

The Earl of Crawford (First Commissioner of Works and Minister of Transport), in replying, said that the cost of road construction and repair was being reduced. Many of the points raised were unsuitable for inquiry by a Parliamentary Committee; they could be much better dealt with by a technical committee. The Departmental Committee which was dealing with the problem was well qualified to consider what changes were necessary. He recognised that noble Lords desired some form of Parliamentary inquiry, and therefore he would not put the House to the trouble of a division.—The motion was agreed to.

THE COUNTY COUNCILS ASSOCIATION.

Various matters affecting roads and motors were considered at the quarterly meeting of the County Councils Association.

Bedfordshire County Council urged the Association to consider the question of the number of wagons which locomotives should be allowed to draw, with a view to securing uniformity.

The Association decided that the general relaxation of the provisions of Section 3 of the Locomotives Act 1898, which was countenanced during the war, should no longer be permitted, and that the consent of County Councils to the drawing of more than three loaded wagons, exclusive of a water cart, should only be given in exceptional circumstances.

Monmouthshire Council urged that steps should be taken to ensure that the use on the roads of steam locomotives not constructed so as to prevent the emission of sparks shall be effectively prohibited. The matter was referred to a sub-committee.

Regarding heavy traffic, the County Councils of Carnarvonshire, Dorset, Durham, Gloucestershire, Lindsey, Merioneth, and East Riding drew attention to the disproportion between the taxation now payable in respect of heavy mechanical vehicles and the damage caused by such vehicles to the roads, and to the consequent necessity of an increase in the existing scale of licence duties, in order that the cost of road upkeep may be more equitably borne.

It was stated that the Association had already decided to urge that 50 per cent. of the cost of all main roads should be provided from Imperial sources, but refused to recommend any alteration of the motor taxes. Nevertheless the matter was referred to a committee to report upon.

In regard to lights on vehicles, the Association decided to urge upon the Government the desirability of introducing at an early date a Bill dealing with the whole subject.

OMNIBUS SERVICES.

HARROGATE.—Subject to the vehicles, fares, etc., being satisfactory, the Corporation have sanctioned an omnibus service by Messrs. Crossley and Holdsworth to Low Harrogate.

LONDON-BRIGHTON.—It is now possible to journey from London to Brighton daily in 5½ hours at a cost of 6s., with only two changes. From Charing Cross the passenger can travel by the London General Omnibus Company's vehicles to West Croydon Station, from whence the East Surrey Traction Company's service runs to Handcross. At the latter place a change is made into the omnibuses of the Southdown Traction Company. Thos. Tilling, Limited, are continuing their petrol-electric service from London to Reigate, where a change can be made into the East Surrey Company's omnibuses to Handcross.

RIPON.—Arrangements have been made for instituting services of motor omnibuses between Ripon, Thirsk, Aldborough, Grewelthorpe, and Harrogate. The service to Grewelthorpe will open up the Kirkby Malzeard district, where for many years the residents had endeavoured to secure the construction of a light railway.

ROTHERHAM-DONCASTER.—Application has been made to the Ministry of Transport by Rotherham Corporation for consent to the running by their tramways department of omnibuses from Thrybergh tramway terminus to Doncaster Road and the Warmsworth terminus of Doncaster Corporation Tramways.

MOTOR VEHICLES FOR MUNICIPALITIES.

ROTHERHAM CORPORATION have been recommended to purchase a motor sweeper.

BATTERSEA HEALTH COMMITTEE have recommended the purchase of two motor vans.

BRADFORD TRAMWAYS COMMITTEE have purchased a van for the parcels department.

GOSPORT URBAN COUNCIL have decided to purchase a motor ambulance at a cost of about £450.

EAST HAM CORPORATION have a scheme for a motor repair shop and a bulk petrol store at a cost of £12,500.

JOHANNESBURG MUNICIPAL COUNCIL have purchased an Enfield-Vickers 8-H.P. motor cycle and side-car and a B.S.A. motor cycle.

WALTHAMSTOW URBAN COUNCIL have asked the electrical engineer to report as to the provision of a conveyance for the mains engineer.

BILLINGE URBAN COUNCIL have asked a sub-committee to report on the advisability of purchasing a motor vehicle for haulage purposes.

HAMPSHIRE STANDING JOINT COMMITTEE report that as horses and carts become worn out the police superintendents will be provided with motor cars.

HARROGATE CORPORATION have sent back for further consideration a proposal of the Electricity Committee to purchase an electric vehicle at a cost of £940.

A KARRIER SWEEPER has just been ordered for the use of the municipal authorities in Rotterdam after one of these machines had undergone a month's trial.

ROTHERHAM CORPORATION have received a suggestion from the Highways Committee to purchase a motor cycle for a foreman whose time is too valuable to waste in walking from job to job.

CHESTERFIELD LICENSING COMMITTEE have granted Mr. Wm. Simpson a hackney carriage licence for an omnibus to carry 14 passengers, to ply between Barlow and Chesterfield, and to stand at Angel Yard, Chesterfield.

ST. PANCRAS WORKS COMMITTEE have authorised the purchase of a Laffley motor sweeper, which the borough surveyor says is superior from the point of view of reliability and strength of construction to the machines at present in use by the Council.

THE METROPOLITAN ASYLUMS BOARD are considering a scheme for the development of the motor ambulance headquarters, so that all the repairs can be dealt with without delay. The Ambulance Committee of the Board have recommended the purchase from Messrs. Clement Talbot, Limited, of six chassis for the sum of £3,600. The bodies will be built at the Board's own works.

GRIMSBY CORPORATION have been recommended by the Health Committee to accept an offer of the Clayton Wagon Company, Lincoln, to supply an electric street watering vehicle complete, on approval, for three months, or return at the option of the Council, but if they decide to purchase the price to be £1,070. The company will supply at their own cost such improvements as may be fitted by them on other vehicles supplied during the three months.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

SHEFFIELD FIRE BRIGADE.—All the horse-drawn appliances of the Sheffield Fire Brigade have now been supplanted by motor vehicles. The first motor machines were introduced in 1907.

CARS FOR CHURCHGOERS.—The trustees of Brunswick Wesleyan Church, Macclesfield, have decided to place motor cars at the disposal of worshippers who require transport to attend the services.

LEYLAND MAY FESTIVAL.—The old time Leyland (Lancs.) May festival commenced on May 25, and Leyland Motors, Limited, followed a practice which has been in vogue for many years in providing motor coaches for conveying the child dancers in the procession through the village to the festival ground.

PARKING OMNIBUSES AT EPSOM.—Last year 200 of the omnibuses of the London General Omnibus Company engaged for private parties on Derby Day were parked for £5 5s. each. This year the Epsom Racecourse Committee intimated that the fee would be increased to £7. The company therefore asked the hirers to make their own parking arrangements.

PETROL TRACTION ON FRENCH RAILWAYS.—As the result of petrol motor traction on light traffic lines, the French State Railways estimate that a saving of from five to ten francs per kilometre can be made on the cost of steam traction, which exceeds 14 francs. The Prefects of Departments have been asked to study the possibility of applying petrol traction to suitable railways.

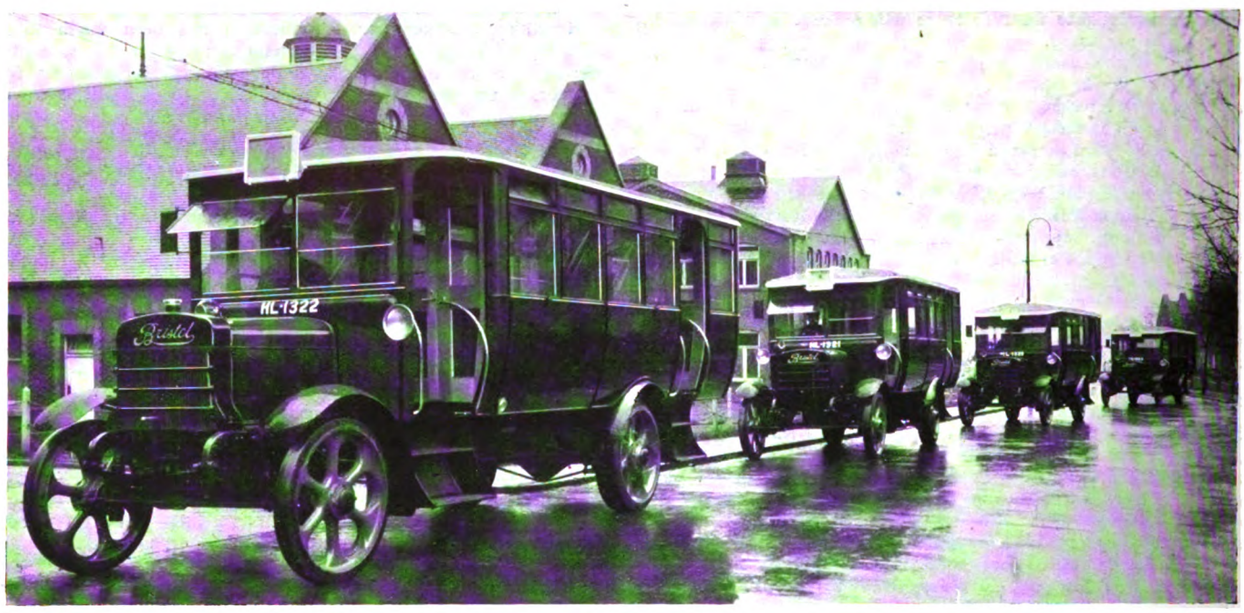
MOTOR VEHICLES IN FRANCE.—In his 1923 Budget proposals the French Minister of Public Works gives statistics showing the increase of motor vehicles. In 1913 there were 8,000 motors out of a total of 100,000 vehicles of all categories. At the beginning of 1921 motor vehicles totalled 208,000, of which 93,000 were lorries. As a result of the increase of motors the upkeep of the roads has become difficult and costly.

PROPOSED SPEED LIMIT FOR ST. HELENS.—Considerable opposition was manifested at a meeting of St. Helens Corporation to a proposal of the Watch Committee to apply for a regulation restricting the speed of all vehicles to ten miles an hour, and to require all vehicles to stop when passengers are entering or leaving a tramway car. Ultimately it was decided to consult with the Ministry of Transport as to making suitable by-laws relating to speed.

STANDING PASSENGERS IN LONDON OMNIBUSES.—An investigation has been made by the London General Omnibus Company into the question whether the five extra passengers allowed to stand in their vehicles prefer a strap suspended from the roof or an upright pole for support. The result shows that the upright pole is preferred. It is more readily adapted to the limited head room, and, moreover, is an indispensable part of the structure in the latest type of omnibus.

ORDER FOR ROYAL WARRANT HOLDERS.—Leyland Motors, Limited, the holders of the King's Royal Warrant as manufacturers of commercial motor vehicles, have been honoured by a repeat order for a 3-ton "Leyland" baggage van for H.M. the King. It is understood that a similar machine which has been in service since 1910 has given complete satisfaction. The chassis is a model "C" 3-ton type, with 30-H.P. engine and worm axle. The wheels are shod with Michelin pneumatic tyres.

NEW BENZOLE MIXTURE.—The National Benzole Company is marketing a new benzole mixture made from all-British benzole and petrol. The company is securing its British-controlled petrol through the Agwi Petroleum Corporation, the necessary refineries having been erected near Southampton. The refinery can already handle over 1,000 tons of crude oil per week, a figure which will shortly be increased to 5,000 tons per week. It is understood that the mixture gives a higher yield than that obtainable by previously known processes.



New Type "Bristol" Omnibus for Wakefield (West Riding) Tramways Company.

LONDON OMNIBUS STOPPING SIGNS.—Owing to the diversity of practice on the part of London local authorities in the matter of omnibus stopping signs, the Ministry of Transport recently took up the question with the Metropolitan Boroughs Standing Joint Committee. A series of regulations have been agreed to which will have the effect of standardising the practice. Each stop sign will bear the name of the street in which it is situated, and the design is to be such that it can be fitted to lamp standards if thought preferable. Voluntary stop signs will have a distinguishing band of colour round the column.

THE ANTI-DAZZLE PROBLEM.—Mr. J. W. Walsh, of the National Physical Laboratory, lectured on the problem of glare from motor headlights before the Optical Society on May 11. Some two thousand devices, he said, had been produced, but the problem might still be regarded as awaiting solution. The difficulty lay in the fact that, while a safe driving light required a beam of at least 3,000 candle-power, it was necessary, in order to avoid glare to drivers of oncoming traffic, to reduce this to about 500 candle-power. There appeared to be no satisfactory method of escape from this position of mutually antagonistic requirements. In the United States the problem had been dealt with by confining the main part of the beam to the region below the horizontal. Mr. Walsh emphasised the desirability of uniformity of anti-dazzle legislation throughout the world, and mentioned that the International Commission on Illumination had appointed a special commission to secure this object.

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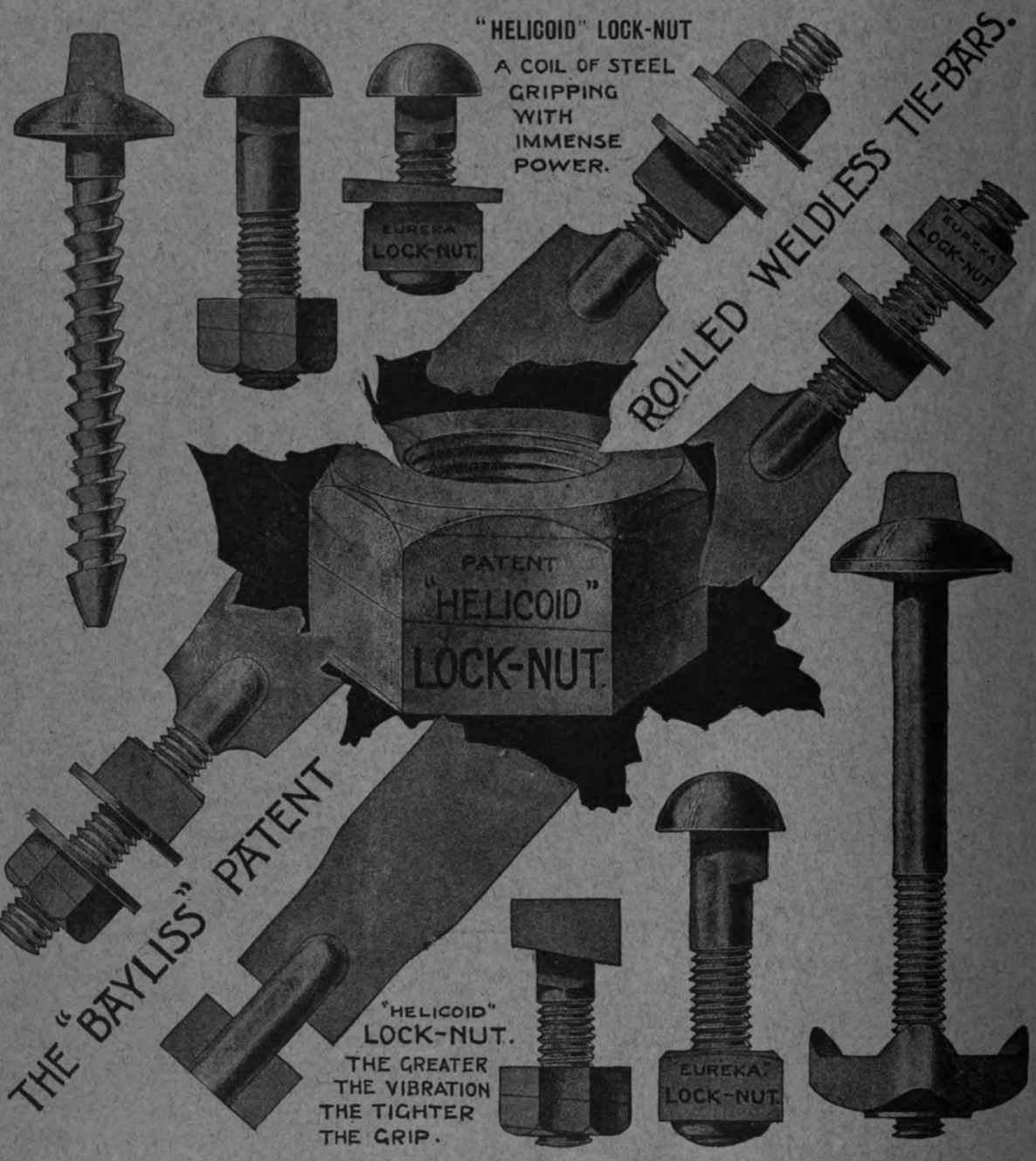

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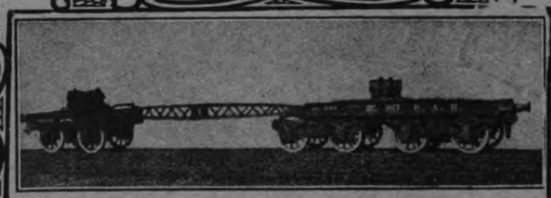

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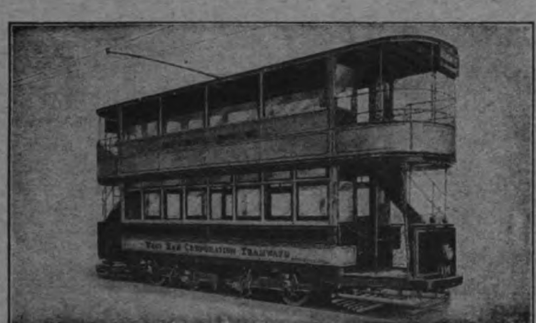

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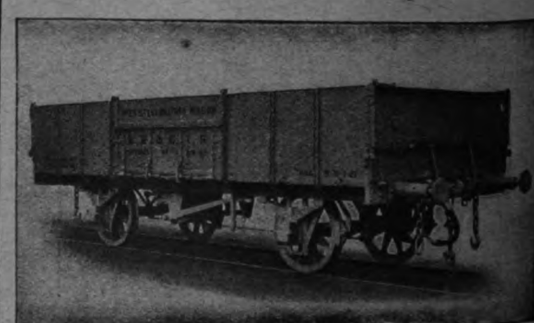

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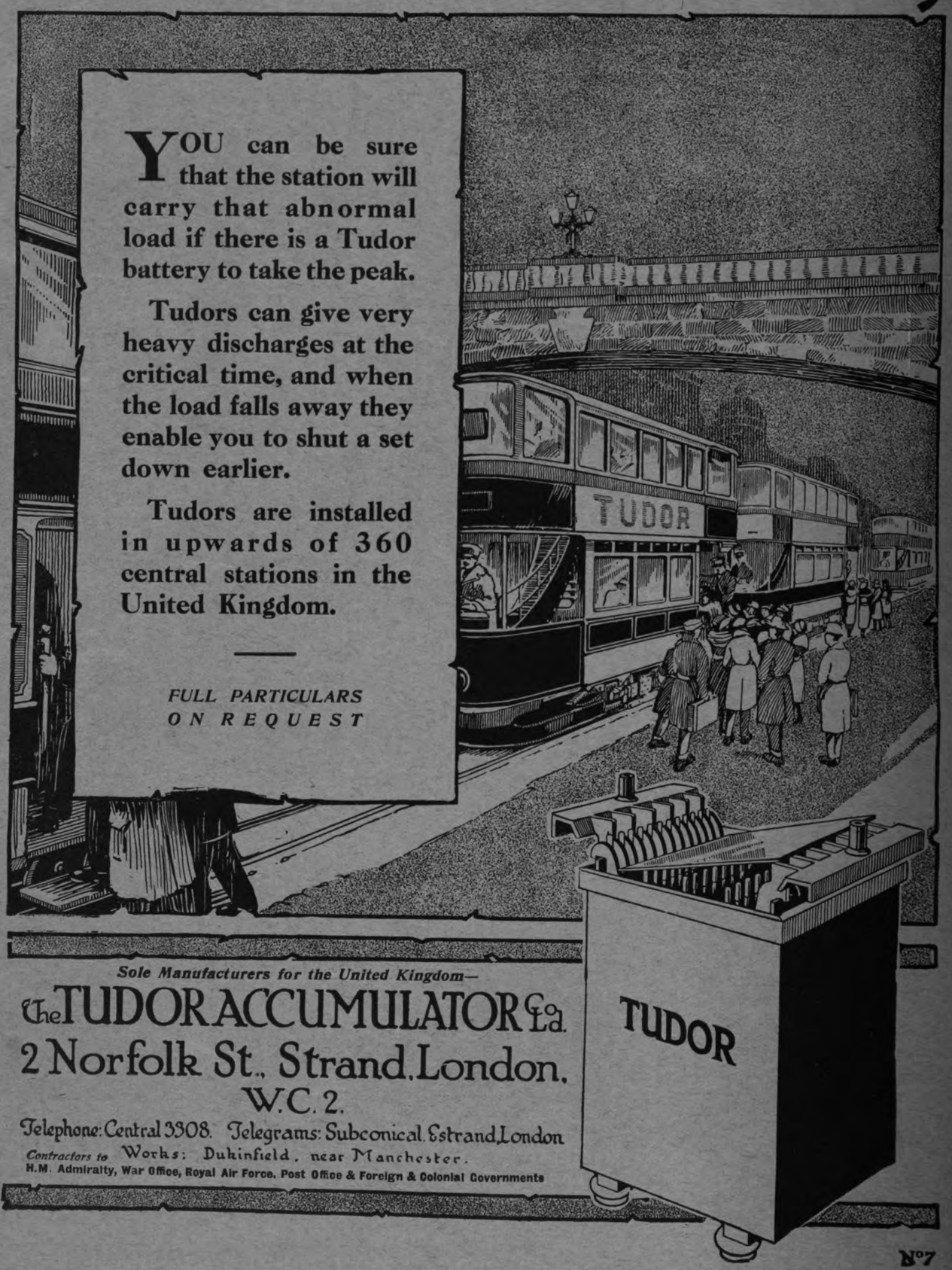

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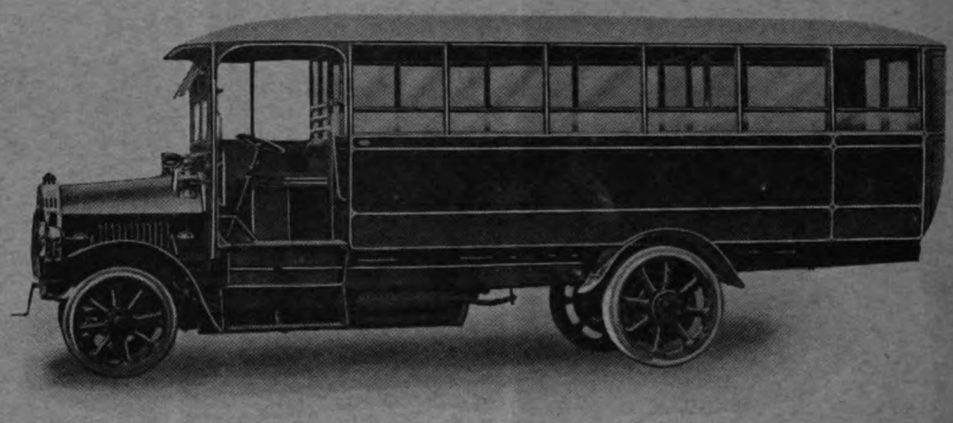

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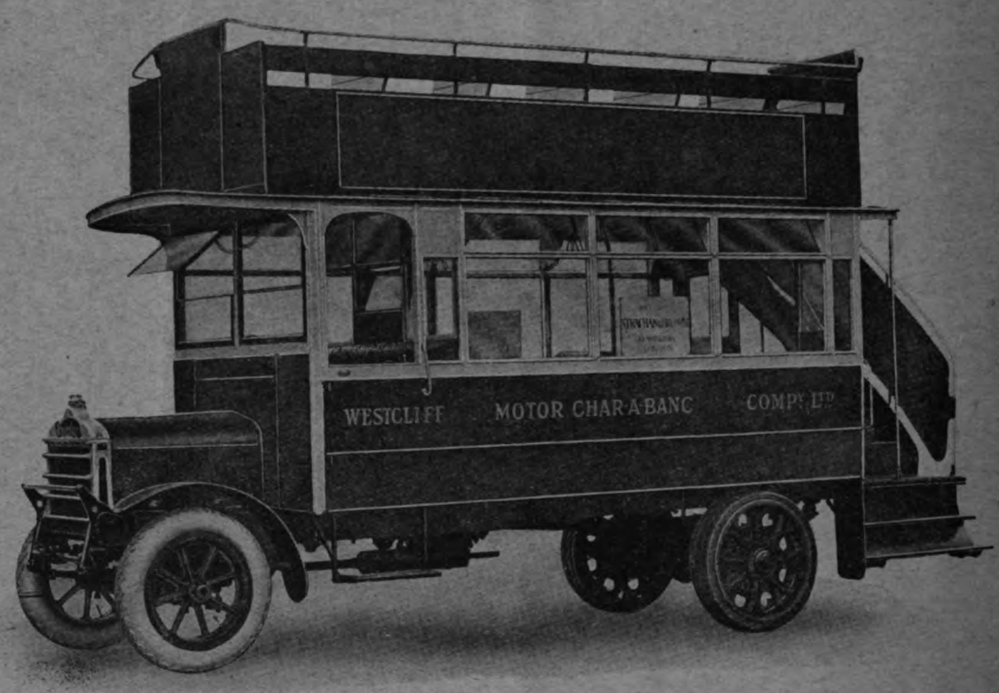

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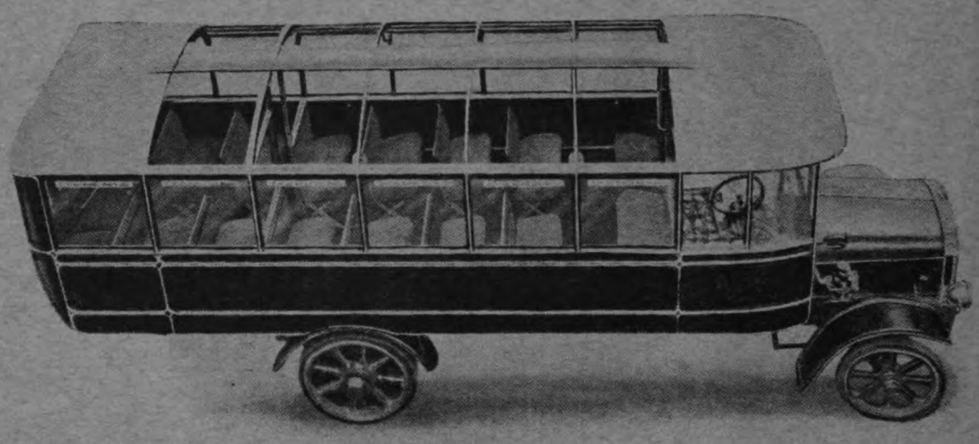

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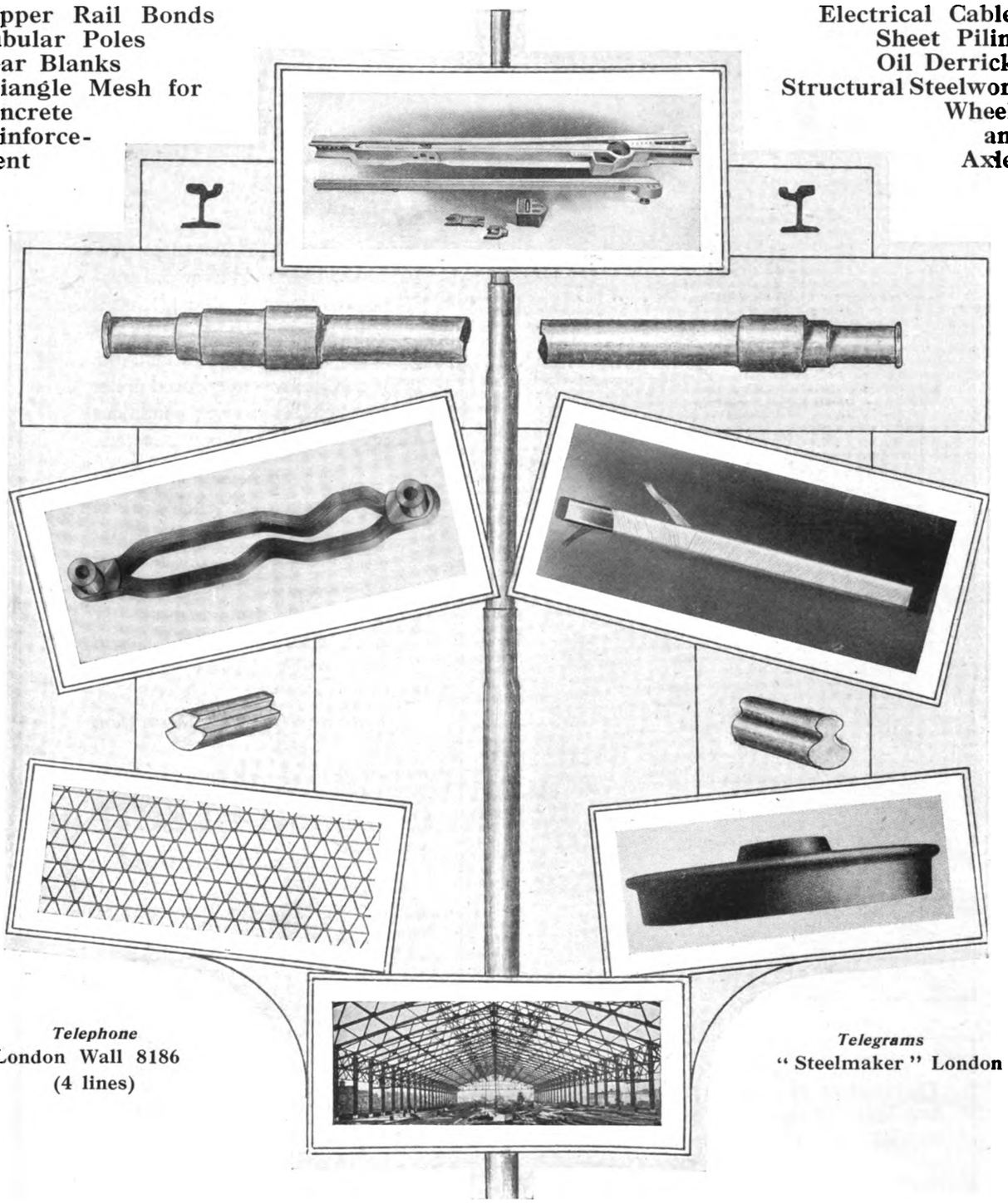

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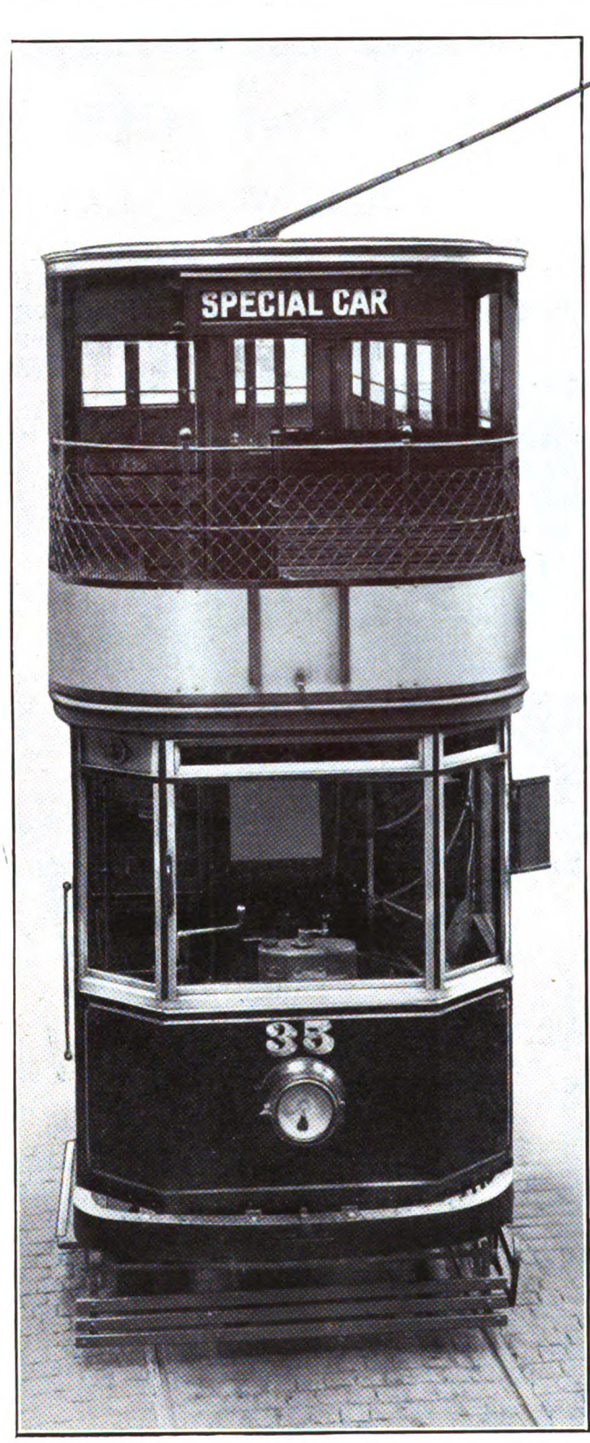

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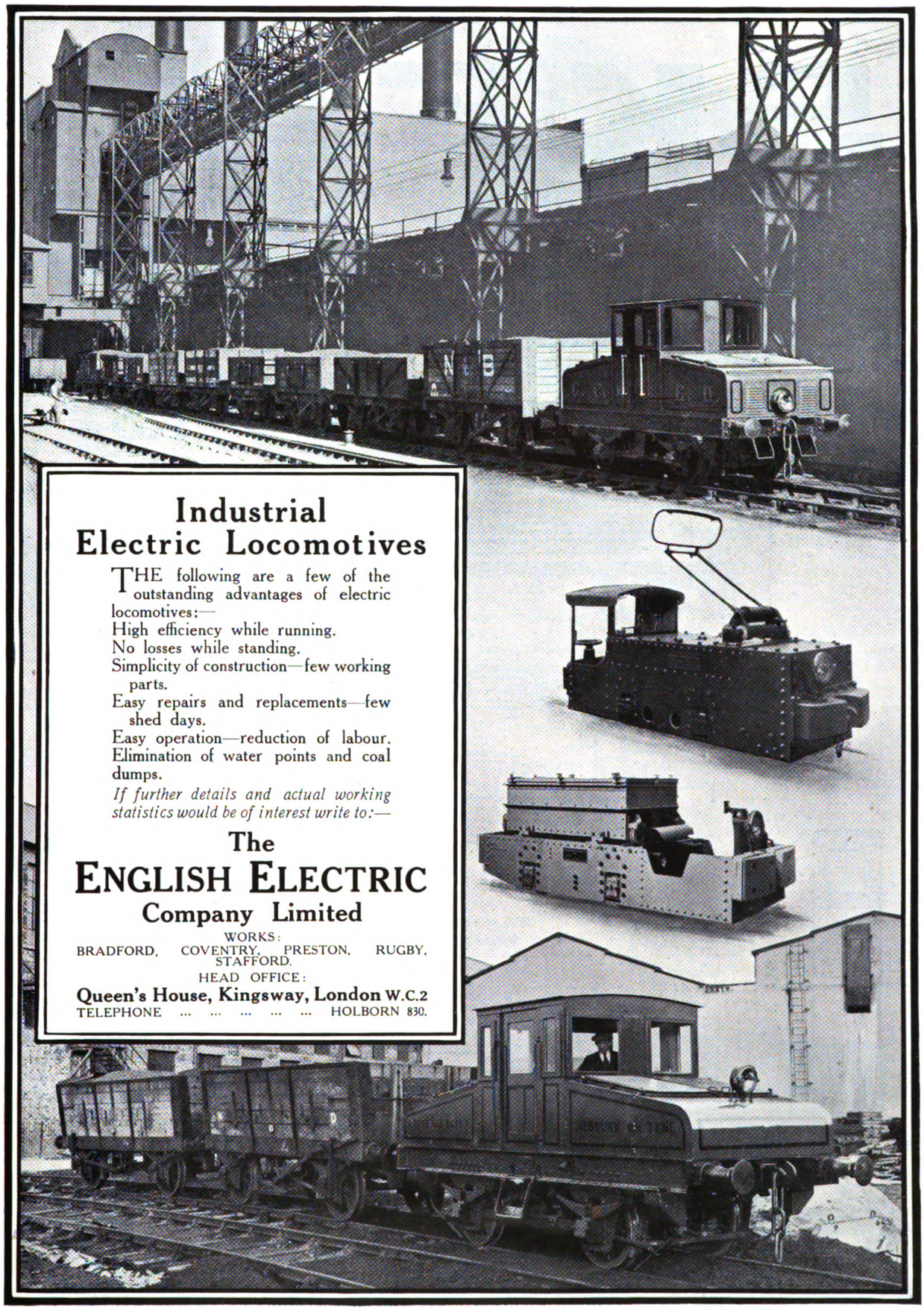

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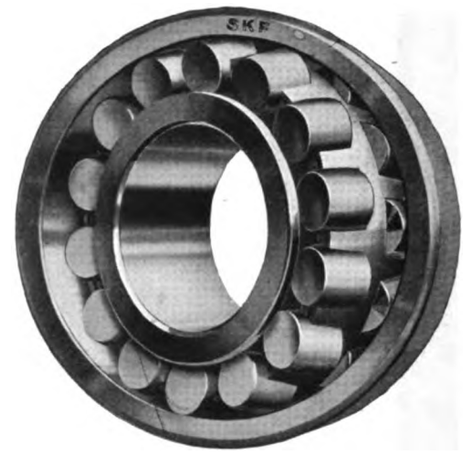

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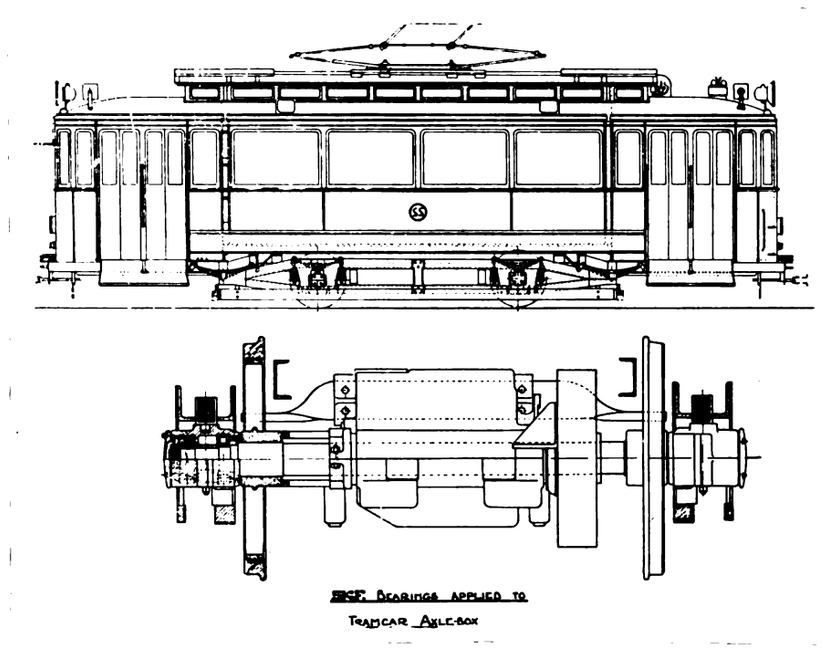

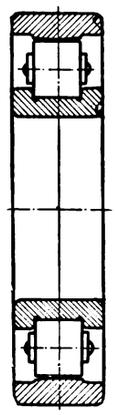

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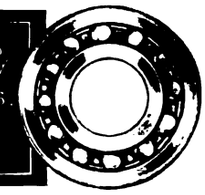

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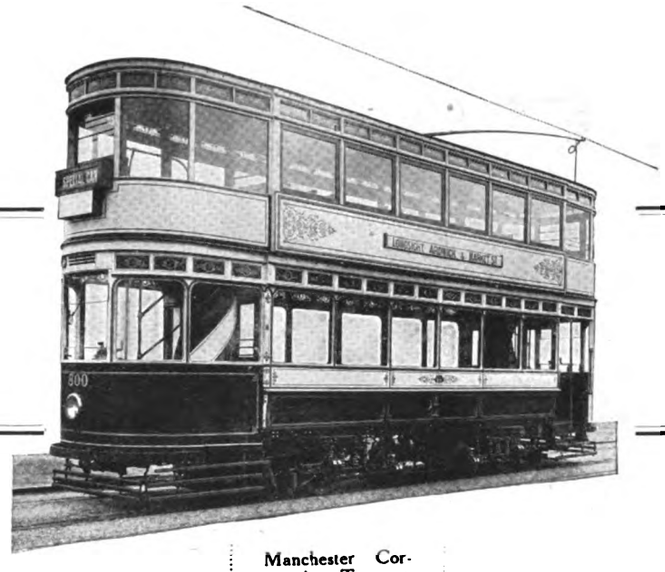
Modern Tramway Motors

Points to look for — and why!



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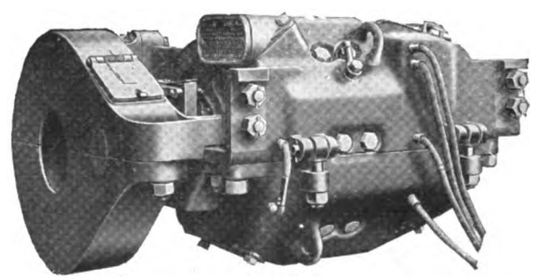

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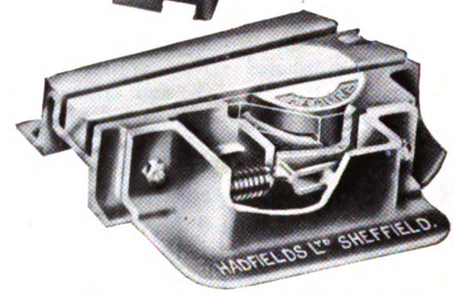

Shows arrangement at Heel End for automatically taking up all wear

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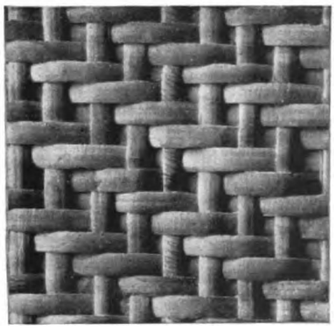

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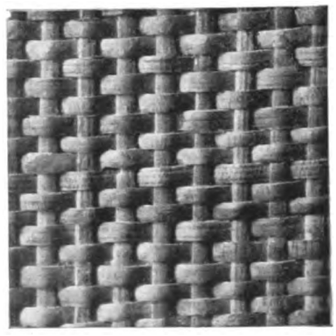

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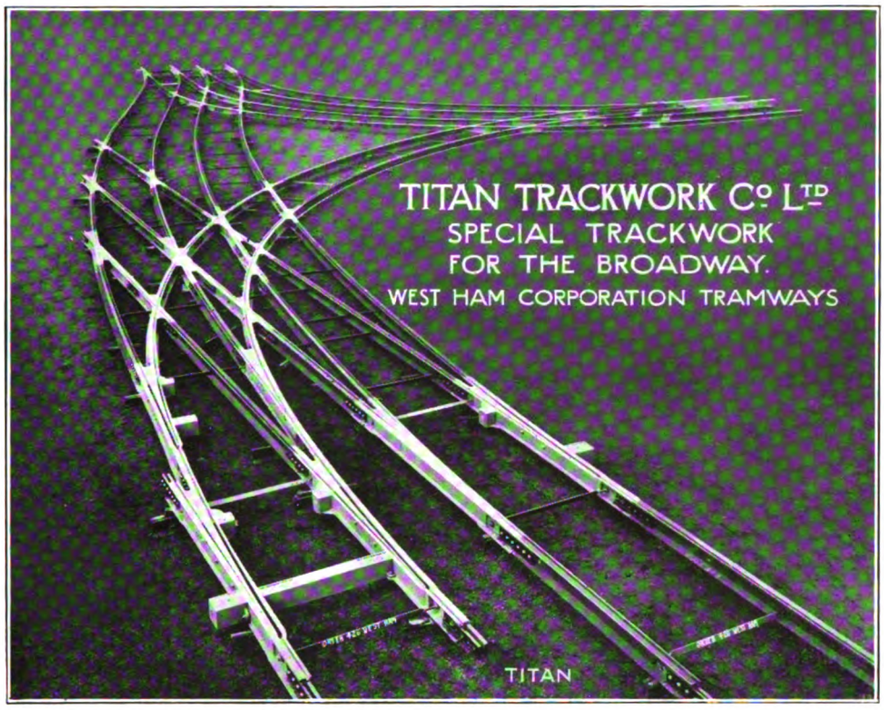

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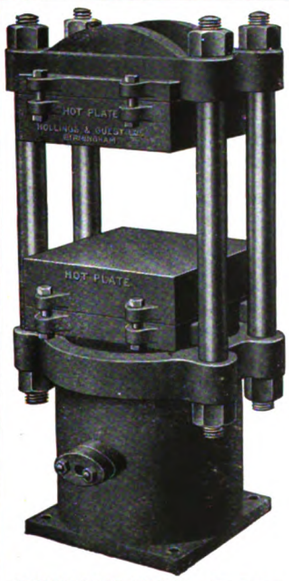

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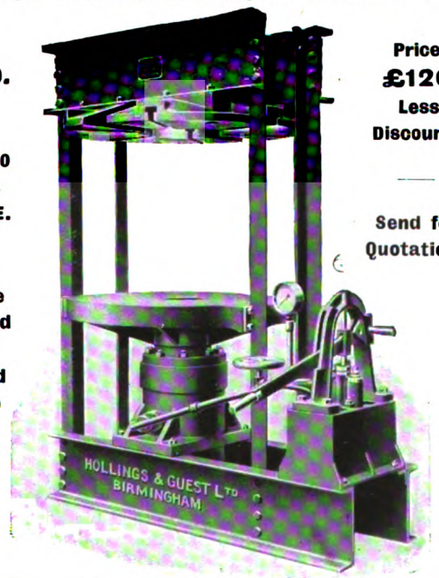

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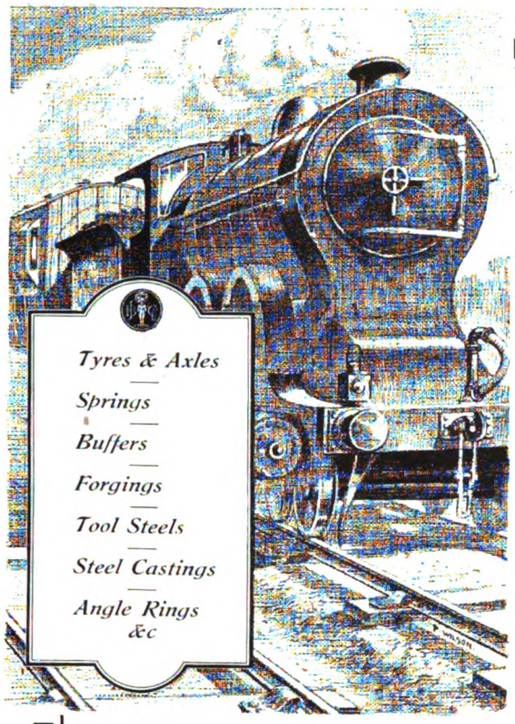

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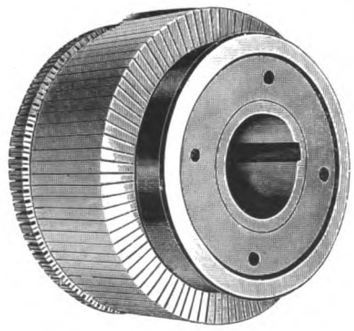

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(*Continued on page xx.*)

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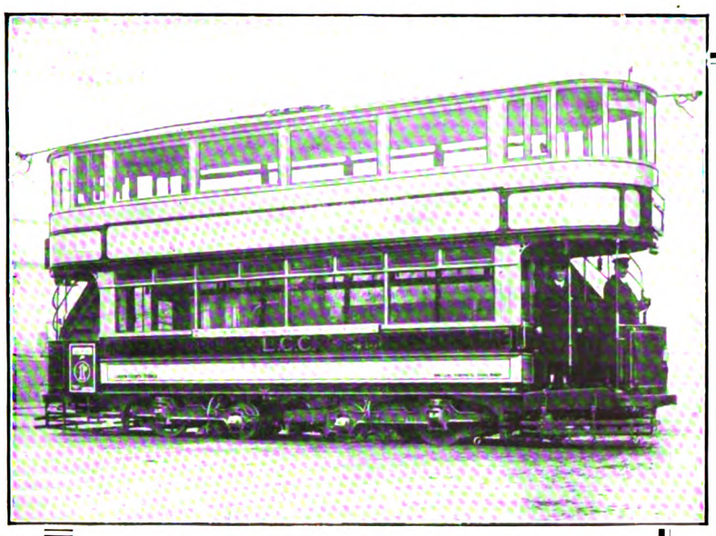

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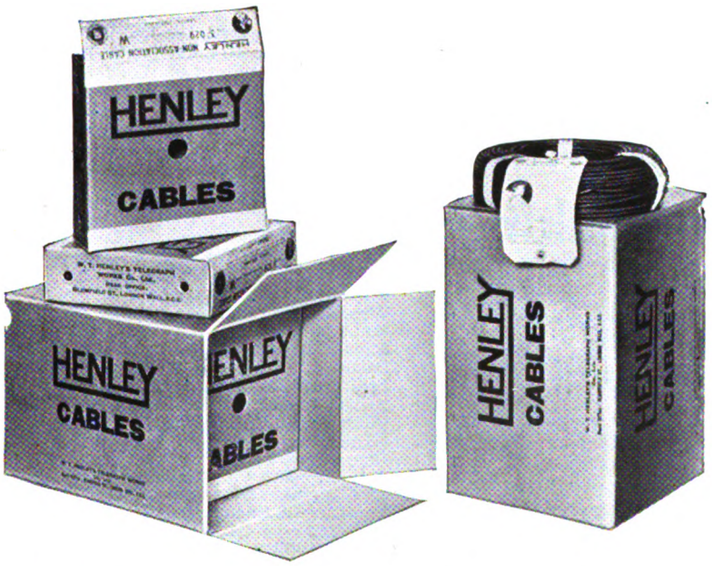

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Hadfields, Ltd., Sheffield.
Lorain Steel Company, London.
Titan Trackwork Co., Ltd., Sheffield.

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British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Metropolitan-Vickers Elec. Co., Manchester.

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The Rail and Road Car Equipment Co.
Yates & Co., Ltd., John, Aston Manor.

RATTAN.
Abbatt & Co., Bolton.
Brill Company, J. G., London, W.C.1.
Continental Railway & Tramway Supply Co.
The Rail and Road Car Equipment Co.

RESISTANCES.
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English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.

ROLLER BEARINGS.
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Hoffmann Manufact'g Co. Ltd., Chelmsford.

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Brill Company, J. G., London, W.C.1.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

SAND BOXES.
Brill Company, J. G., London, W.C.1.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

SAND DRYERS.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd, Leeds.

SEATS AND SEATING MATERIALS.
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Brill Company, J. G., London, W.C.1.
Continental Railway & Tramway Supply Co.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
The Rail and Road Car Equipment Co.

SIDE GUARDS.
Equipment & Engineering Co., London, W.C.

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Equipment & Engineering Co., London, W.C.

SNOW PLOWS.
Brill Company, J. G., London, W.C.1.

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Brown, Bayley's Steel Works, Ltd., Sheffield
Hadfields, Ltd., Sheffield.
Terry & Sons, Ltd., Herbert, Redditch.

SPRINGS (LAMINATED AND SPIRAL.)
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SPRINKLING CARS.
Brill Company, J. G., London, W.C.1.
English Electric Co., Ltd., London, W.C.

STEAM TURBINES.
British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Fraser & Chalmers Engineering Works, Erith.
Metropolitan-Vickers Elec. Co., Manchester.

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Leyland Motors, Ltd., Leyland, Lancs.

STEEL FORGINGS.
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Brill Company, J. G., London, W.C.1.
Brockhouse, J., & Co., Ltd., West Bromwich.
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Electro-Mechanical Brake Co., W. Bromwich.
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Hadfields, Ltd., Sheffield.

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Fleming, Birkby & Goodall, Ltd., Liversedge.
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Brill Company, J. G., London, W.C.1.
English Electric Co., Ltd., London, W.C.

SWITCHBOARDS AND GEAR.
British Thomson-Houston Co., Rugby.
Edison Swan Electric Co., Ltd., Ponders End, Middlesex.
English Electric Co., Ltd., London, W.C.
Johnson & Phillips, Ltd., Charlton, S.E.
Metropolitan-Vickers Elec. Co., Manchester.
Tramway Supplies, Ltd., Leeds.

SWITCHES, ELECTRICAL.
British Thomson-Houston Co., Ltd., Rugby.
Edison Swan Electric Co., Ltd., Ponders End, Middlesex.
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Allen, Edgar, & Co., Ltd., Sheffield.
Baker, John, & Co., Rotherham.
Brown, Bayley's Steel Works, Ltd., Sheffield.
Equipment & Engineering Co., London, W.C.
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TOWER WAGONS.
Equipment & Engineering Co., London, W.C.
Leyland Motors, Ltd., Leyland, Lancs.
Tilling-Stevens Motors Ltd., Maidstone.
Tramway Supplies, Ltd., Leeds.

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Electro-Mechanical Brake Co., W. Bromwich.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C
Tramway Supplies, Ltd., Leeds.

TRACK SANDERS.
Brill Company, J. G., London, W.C.1.
Equipment & Engineering Co., London, W.C.
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Electro-Mechanical Brake Co., W. Bromwich.
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Equipment & Engineering Co., London, W.C.
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Brill Company, J. G., London, W.C.1.
English Electric Co., Ltd., London, W.C.
Peckham Truck & Eng. Co., London, E.C.
Tramway Supplies, Ltd., Leeds.

TRUCKS, CAR.
Brill Company, J. G., London, W.C.1.
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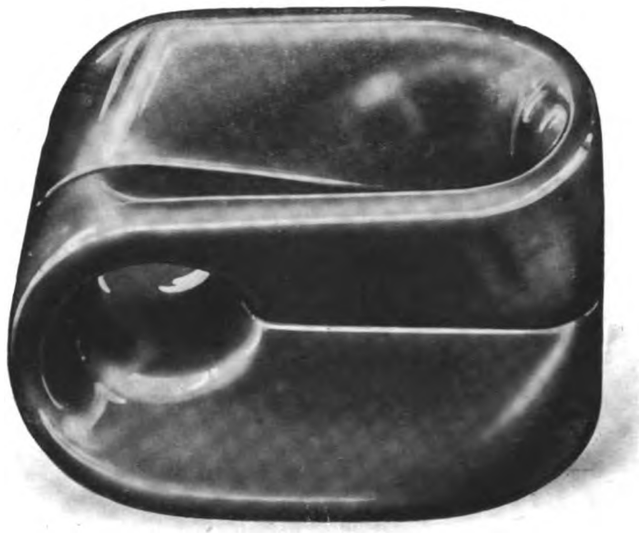

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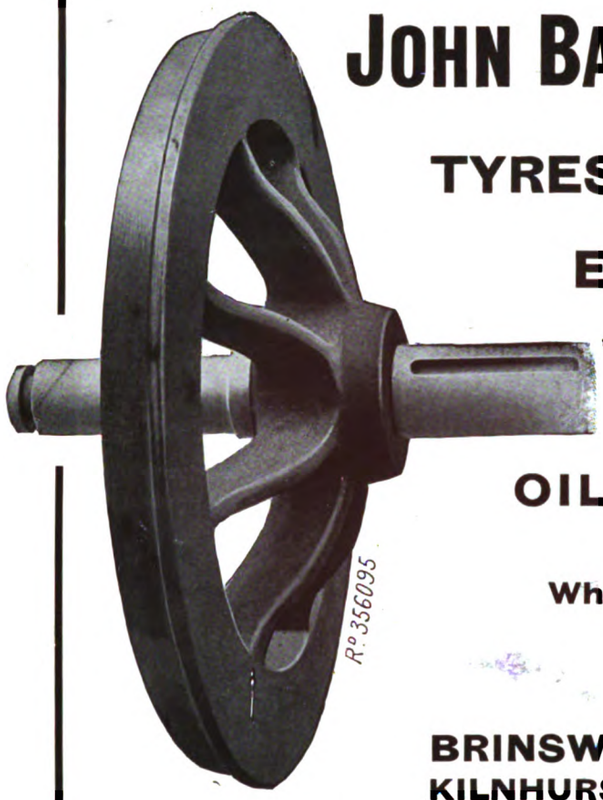

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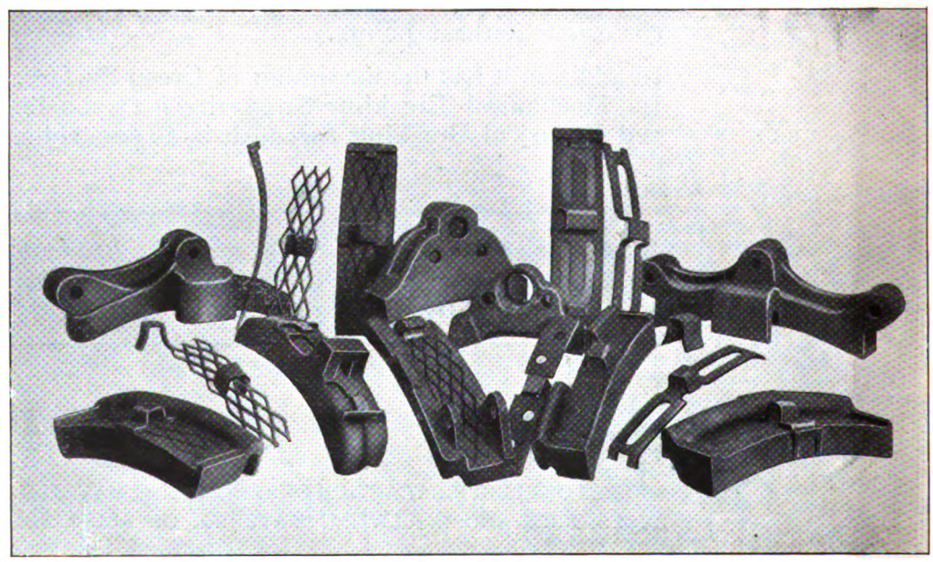

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IN THE UNITED KINGDOM

Municipal Tramways pp. xxiii-xxiv. Company Tramways pp. xxiv-xxvi. Tramway Associations p. xxvi.

NAMES OF PRINCIPAL OFFICERS
POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS

***** In order that these Directories may be kept up to date, it is specially requested that intimation of all changes be sent promptly.**

Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. R. L. Berry.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen; T.N. 826.] *Gen. Manager and Eng.*, W. Forbes; *Per. Way Eng.*, J. Gordon (*Burgh Surveyor*); *Chairman Try. Com.*, Coun. D. W. Beaton.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. F. Lord.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Charles I. Baker; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. C. H. Waterhouse.

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 123.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Bailie J. Smith; *Vice-Chairman*, Coun. T. Murray.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. [Lines leased to and worked by Rawtenstall Corporation.] *Town Clerk*, J. Entwistle; *Boro' Eng.*, G. Bradley; *Chairman Try. Com.*, Coun. J. Ireland; *Vice-Chairman*, Ald. J. H. Lord.

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. A. Whiting.

Barrow Corporation Tramways, Salthouse Road, Barrow-in-Furness. *Manager*, J. R. Groves; *Chairman Try. Com.*, Lieut.-Col. R. Thompson.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.
[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. F. W. H. Auty; *Vice-Chairman*, Coun. J. W. Schofield.
[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Tramways, Belfast; T.N., 2444.] *Gen. Manager*, J. S. D. Moffet; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, Johnstone Wright; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, H. Vernon; *Chairman Try. Com.*, Coun. W. G. Turner; *Vice-Chairman*, Coun. D. Anderson.

Bexley Urban District Council Tramways and Dartford Light Railways. Broadway, Bexleyheath, Kent. [T.A., Makin, Tramways, Bexley; T.N., 79.] *Gen. Manager and Elec. Eng.*, J. Makin; *Chairman Try. Com.*, Coun. A. J. Franklin.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Ald. S. Vaughan.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *Assistant General Manager*, J. McDonnell; *Chief Engineer*, A. C. Baker; *Elec. Eng.*, T. Rowland; *Traffic Supt.*, L. Johnson; *Per. Way Eng.*, G. Warner; *Car Works Supt.*, T. C. Winfield; *Chairman Try. Com.*, Coun. F. Smith.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 4321.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, R. Riley; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. C. Higham; *Vice-Chairman*, Coun. Geo. Burke.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Manager*, H. H. Lancaster; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Coun. H. Brooks; *Vice-Chairman*, Coun. T. G. Lumb.

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Coun. J. R. Horrocks; *Vice-Chairman*, Ald. P. Higson.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Ashton.
[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Wootton Gardens, Bournemouth. [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, G. F. Glass; *Chairman Try. Com.*, Coun. J. Wilson; *Vice-Chairman*, Coun. W. H. Ridout.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, R. H. Wilkinson; *Asst. Elec. Eng.*, Johnstone Wright; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Ald. Enoch Priestley; *Vice-Chairman*, Coun. Taylor.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Ald. J. Lintott.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. L. Thornber; *Vice-Chairman*, Coun. Eastwood.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland; *Vice-Chairman*, Ald. T. E. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, Frank Buckley; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge, J.P.; *Vice-Chairman*, Ald. H. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. T.N., 1211, 1240, 1350, and 377.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, C. G. M. New; *Traffic Manager*, H. David; *Rolling Stock Supt.*, Jas. Preston; permanent way under supervision of *City Engineer*, E. J. Elford; *Chairman Try. Com.*, Coun. S. O. Jenkins; *Vice-Chairman*, Coun. A. E. Gough.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Manager*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager*, R. H. Campion; *Assist. Gen. Manager*, D. H Davies; *Chairman Try. Com.*, Coun. P. M. Robinson; *Vice-Chairman*, Ald. Sir E. Shentall.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. G. F. Wright; *Vice-Chairman*, Coun. T. W. Watts.

Colne Corporation Tramways, Colne, Lancashire. *Gen. Manager and Engineer*, J. H. Thompson; *Chairman Try. Com.*, Coun. J. Thompson; *Vice-Chairman*, Coun. R. Knight.

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Chief Engineer*, P. H. Roscoe; *Accountant and Chief Clerk*, H. A. Goodyer; *Chairman*, Coun. E. O. French; *Vice-Chairman*, Coun. J. I. Bates.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Coun. A. A. Thomson; *Vice-Chairman*, Ald. G. J. Allen, J.P.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2435.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. Sir C. Starmer.

Dartford Urban District Council Light Railways, Dartford. *Chairman Try. Com.*, Coun. A. J. Franklin.
[Lines worked by Bexley U.D. Council, *q.v.*]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, G. A. Newsome; *Boro. Elec. Eng.*, F. M. Fletcher; *Chairman Try. Com.*, Coun. G. Butterworth; *Vice-Chairman*, Coun. G. Pickup.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. W. Eaton, J.P.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager*, T. Potts; *Elec. Eng.*, S. R. Windle; *Chairman Try. Com.*, Ald. S. Balmforth; *Vice-Chairman*, Coun. T. Bramworth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. H. Bond; *Per. Way Eng.*, Wm. Boulton Smith (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick (Mayor); *Vice-Chairman*, Coun. Thomas.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, W. T. Young; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Coun. J. G. Fraser.

East Ham Corporation Tramways, Nelson Street, East Ham. [T.N., 511 and 100 East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Coun. H. I. Rolf; *Vice-Chairman*, Coun. H. N. Ridley.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Coun. Alexander; *Vice-Chairman*, Ald. Pearson. [Lines worked by Salford Corporation.]

Edinburgh Corporation Tramways, 2, St. James' Square, Edinburgh. *Gen. Manager*, R. S. Pilcher; *Traffic Supt.*, R. McLeod; *Burgh Engineer*, A. H. Campbell; *Chairman Try. Com.*, Coun. C. J. M. Mancor.
[The entire system of the Edinburgh tramways is at present worked by cable traction, with the exception of 1½ miles of electric lines. The Council has decided to electrify the whole of the system, and the work has been commenced.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. W. F. B. Howell.

Exeter Corporation Tramways, Heavitree Road, Exeter. *Gen. Manager*, R. O. Baldwin; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Coun. F. Chick; *Vice-Chairman*, Coun. W. Brock.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. Winter; *Vice-Chairman*, Coun. R. H. Cunliffe, J.P.
[Lines leased to the South Lancashire Trys. Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Deputy Gen. Manager*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Deputy Chief Eng.*, G. G. Braid; *Sec. and Treasurer*, J. N. Wilson; *Chairman Try. Com.*, Bailie J. M'Whirr; *Vice-Chairman*, Bailie R. Laing.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts (Mayor); *Vice-Chairman*, Coun. W. Colwell.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Ald. D. McCowan; *Vice-Chairman*, Coun. R. H. Tunbridge.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36.] *General Manager*, B. Hall; *Try. Eng.*, J. W. Galloway; *Chairman Try. Com.*, Ald. Thos. Hey, J.P. (Mayor); *Vice-Chairman*, Ald. H. H. Sutcliffe.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager, Elec. Eng., and Per. Way Eng.*, Barnes Kay; *Chairman Try. Com.*, Coun. Haworth; *Vice-Chairman*, Ald. E. Russell.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Manager*, P. W. Carey.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, H. C. Day; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Ald. J. Ashworth, J.P.; *Vice-Chairman*, Coun. Nuttall.

Huddersfield Corporation Tramways, John William Street, Huddersfield. [T.N., 698 and 398.] *Gen. Manager and Eng.*, A. A. Blackburn; *Track Eng.* W. Jaggar (Borough Eng.); *Elec. Eng.*, J. W. Turner; *Traffic Supt.*, T. Hartley; *Chairman Try. Com.*, Coun. T. Canby; *Vice-Chairman*, Coun. T. Woffenden.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation] *Manager*, E. S. Rayner; *Traffic Supt.*, C. F. Ellwood; *Engineer*, F. W. Bricknell (City Engineer) [T.N., 943, Corporation]; *Chairman Try. Com.*, Coun. A. D. Willoughby; *Vice-Chairman*, Coun. C. P. Sherwood.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. G. R. Davey; *Vice-Chairman*, Coun. H. L. Crofts.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Black, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, A. S. Black; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome (Mayor); *Vice-Chairman*, Coun. W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.
[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 263.], *Gen. Manager and Tramways Engineer*, ———; *Boro. Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. J. Crabtree.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, J. H. Menzies; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Coun. R. Dunlop.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Acting Boro. Electrical Engineer and Tramways Manager*, J. B. Patterson; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. I. J. Curwen.

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 21601; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Highways and Per. Way Eng.*, E. W. Cockerlyne; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *City & Try. Eng.*, E. G. Mawbey; *City Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. G. Banton, J.P.; *Vice-Chairman*, Coun. Billings.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.]—Incorporated with Edinburgh Tramways.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [These Tramways are now worked by the London County Council.]

Lincoln Corporation Tramways, Burton Road, Lincoln. [T.N., 213]. *General Manager*, Richard Hoggard; *City Elec. Eng.*, Stanley Clegg; *Chairman Tramways and Motors Com.*, Ald. W. S. White.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 2580 and 3880, Central.] *General Manager*, P. Priestly; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *Rolling Stock Supt.*, J. W. Thorpe; *Chairman Try. Com.*, Coun. F. C. Wilson; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 23, Belvedere Road, Lambeth, London, S.E.1. [T.A., Lotram, Watloo, London; T.N., 3150 Hop] *General Manager*, A. L. C. Fell; *Traffic Manager*, J. K. Bruce; *Electrical Engineer*, P. L. Riviere; *Rolling Stock Eng.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, C. W. Matthews; *Vice-Chairman*, Lieut. Col. A. C. H. Kennard.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett; *Vice-Chairman*, Coun. Walton.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Ald. D. T. J. Lyle (Mayor); *Vice-Chairman*, Coun. T. J. Armstrong.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Asst. Manager*, James Wood; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesbrough Corporation Tramways, Middlesbrough. *Gen. Manager*, H. G. Jeken; *Chairman, Try. Com.*, Coun. E. Turner; *Vice-Chairman*, Ald. J. Calvert.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Ald. F. Goodyear.

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Ald. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 5193 Central.] *Gen. Manager and Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Ald. R. Mayne; *Vice-Chairman*, Coun. Sir A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 3111 and 2932, Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Tramways Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways, St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Ald. James; *Vice-Chairman*, Coun. J. C. Wareing.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. J. Clarkson; *Vice-Chairman*, Ald. A. Turney.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1495.] *Gen. Manager & Eng.*, Wm. Chamberlain; *Traffic Supt.*, M. Mullin; *Chairman Try. Com.*, Coun. J. K. Cheetham; *Vice-Chairman*, Coun. W. H. Sharpe.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. W. Munro.

Plymouth Corporation Tramways, Drake Circus, Plymouth. [T.N. 518, Plymouth.] *Gen. Manager and Engineer*, H. P Stokes; *Chairman Try. Com.*, Ald. Sir Thos. Baker; *Vice-Chairman*, Coun. C. Harding.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Supt.*, A. Armstrong; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. H. G. Barnes.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 4910 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson, K.B.E., J.P.; *Vice-Chairman*, Coun. E. H. Privett.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 278.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Assistant Manager and Engineer*, H. Clayton; *Chairman, Try. Com.*, Ald. T. Parkinson; *Vice-Chairman*, Ald. J. Ormrod.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. J. H. Lund.

[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Coun. H. Crabtree; *Vice-Chairman*, Ald. R. Ashworth.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.* J. M. Calder; *Chairman Try. Com.*, Ald. C. G. Field, J.P.

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, S. H. Morgan; *Rolling Stock Supt.*, A. R. Williams; *Chairman Try. Com.*, Ald. J. Taylor.

Rotherham Corporation Tramways, St. George's Hall, Rotherham. [T.A., Tramways, Rotherham; T.N., 152 and 241.] *General Manager*, T. P. Sykes; *Per. Way Eng.*, T. P. Collinge; *Traffic Supt.*, W. G. Marks; *Rolling Stock Supt.*, H. B. Sharp; *Chairman Try. Com.*, Ald. G. Gummer, J.P.; *Vice-Chairman*, Coun. Ellis.

St. Annes-on-the-Sea Council Tramways, Squires Gate, South Shore, Blackpool. [T.N., 327.] *Gen. Manager*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Chairman Try. Com.*, Coun. A. E. H. Lee.

St. Helens Corporation Tramways, Hall Street, St. Helens, Lancs. *Gen. Manager*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. A. Rudd, J.P.; *Vice-Chairman*, Coun. J. Hewitt.

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. W. H. Barrett; *Vice-Chairman*, Coun. H. S. Hind.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Assist. Man.*, H. Watson; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. and Motors Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Ald. W. C. Fenton, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, Coun. F. F. Rhodes; *Vice-Chairman*, Coun. H. Bradley.

[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager*, J. Dobson; *Boro. Elec. Eng.*, W. G. Turner; *Traffic Superintendent*, A. Scorey; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. T. Fayle; *Per. Way Eng.*, R. H. Dyer (*Acting Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Coun. G. Radford.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Acting Piermaster*, J. C. Herbert; *Chairman*, Coun. F. Britain.

Southport Corporation Tramway, 1, Eastbank Street, Southport. [T.N., 551.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, Edgar Moxon; *Chairman Try. Com.*, Ald. T. S. Richardson; *Vice-Chairman*, Coun. J. Lloyd.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, J. Edgar; *Chairman Try. Com.*, Coun. J. G. Winskell.; *Vice-Chairman*, Coun. Stephenson.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. R. Wood; *Vice-Chairman*, Ald. J. E. Rhodes.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Coun. T. W. Potts, O.B.E.; *Vice-Chairman*, Coun. W. Merrison.

Stockton and Thornaby Corporations Joint Tramways, Bridge Road, Stockton-on-Tees. [T.A., Tramways, Stockton; T.N., 129.] *Gen. Manager*, A. Forster; *Chairman Try. Com.*, Coun. R. M. Elliott.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Per. Way Eng.*, T. Inglis Rudman; *Chairman Try. Com.*, Ald. G. New, J.P.; *Vice-Chairman*, Ald. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways Swindon T.N., 4.] *General Manager*, T. Medcalf; *Elec. and Mech. Eng.*, A. Nicklin; *Chairman Try. Com.*, Ald. G. H. Stevens; *Vice-Chairman*, Coun. G. Mabberley.

Tees-side Railless Traction Board, Middlesbrough Road, South Bank, Yorkshire. [T.A. Railless Board, South Bank; T.N., 31, South Bank]. *General Manager and Engineer*, J. B. Parker; *Chairman* Councillor W. G. Grace.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1431, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, B. T. Hawkins; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. S. H. Roberts.

Walsall Corporation Tramways, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager and Engineer* Chas. Burgess; *Chief Assistant*, J. R. Taylor; *Rolling Stock Supt.*, M. J. Somerfield; *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. B. Clarkin.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Ald. Sir. P. Peacock. J.P.; *Vice-Chairman*, Ald. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Highways Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Coun. Wheatley.

[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 862 and 868 East.] *General Manager*, L. Slattery; *Boro' Elec. Eng.*, F. W. Purse; *Chairman Try. Com.*, Coun. Husband.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager and Eng.*, T. G. Richardson; *Chairman Try. Com.*, Coun. H. Salmon; *Vice-Chairman*, Coun. Turnbull.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *General Manager and Eng.*, W. M. Milnes; *Rolling Stock Supt.*, J. H. Birch; *Traffic Supt.*, J. Brierley; *Per. Way Eng.*, R. B. Donald; *Chairman Try. Com.*, Ald. R. T. Fletcher; *Vice-Chairman*, Ald. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir S. Craddock; *Vice-Chairman*, Coun. Davies.

Yarmouth Corporation Tramways (See Great Yarmouth Corporation Tramways).

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. A. Bromley; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. C. W. Shipley; *Vice-Chairman*, Coun. J. G. Gibbs.

COMPANY TRAMWAYS

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 2583.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, Dr. W. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, S. J. Rowe; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, G. J. Somerville, P. N. Gray.

[These Tramways have been purchased by Glasgow Corporation.]

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley [T.A., Tramways, Barnsley; T.N., 159.], and Electrical Federation Offices, Kingsway, W.C. *General Manager*, W. E. Nicoll; *Sec.*, S. M. Wright; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris, P. N. Gray, L. M Myers.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow.

[These Tramways have been purchased, and are now worked by Barrow-in-Furness Corporation.]

Bath Electric Tramways Company, Ltd., 10, Northgate Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Sec.*, H. J. Almond; *Chairman*, J. B. Hamilton; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton.

Bessbrook and Newry Tramway Company Bessbrook, Co. Armagh. [T.A., Tramway, Bessbrook.] *Manager*, R. Hamilton; *Chief Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, J. M'Gregor Greer.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, R. J. Howley.

Blackpool and Fleetwood Tramroad. [This Tramway is now owned and worked by Blackpool Corporation.]

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, Miss Barton; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Colonel S. E. Smith; *Assist. Manager*, W. H. Stradling; *Electrical Engineer*, W. Nairn; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, J.P., Sir G. Stanley White, Bart., S. E. Baker, Chas. Challenger.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. J. S. Austen (*chairman*); *Directors*, E. Garcke (*Dep. Chairman*); C. Shirreff Hilton, W. L. Madgen, Sir E. C. K. Ollivant, A. Shepherd, C. G. Tegetmeier, P. D. Tuckett, *Manager*, C. H. Dade; *Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Birmingham & District Power & Traction Co.:
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
London and Suburban Traction Co.
Merthyr.
Middleton.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railway, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, W. N. Bancroft; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Hards; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Sir Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, E. W. Sleight.

Chatham and District Light Railways Company, Luton Road, Chatham, and Crown House, Aldwych, London, W.C.2. [T.A., Tramways, Chatham; T.N., 51.] *Gen. Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Chairman*, A. R. Holland; *Directors*, A. H. Beatty, W. Shearer, H. L. Williams, H. J. McCormick; *Sec.*, Wm. C. Bryden, C.A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, Dalkeith, Gloucester Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, T. Pollock; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Co., Ltd., Albert Street, Cork [T.A., Tramways, Cork; T.N., 78 and 535.], and Crown House, Aldwych, London, W.C.2. *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, Maj. W. Martindale, H. C. Levis, Dr. W. L. Murphy, A. H. Walton.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Bexley Urban District Council, Broadway, Bexleyheath, Kent).

Devonport and District Tramways Company, Electrical Federation Offices, Kingsway, London, W.C. *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[This Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 62 and 63, Queen Street, London, E.C.) [T.A., Overhauled, London; T.N., 6616 and 6617 City.] *Manager*, W. McGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company). 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, E. A. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins, W. R. Hart.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282, 4005 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, J.P., A. B. Coyle, J.P., G. V. Murphy, J. R. Dillon.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, ————; *Chairman*, Rt. Hon. L. A. Waldron, P.C.; *Directors*, Joseph Mooney, J.P., William Hewat, Capt. Wm. L. Murphy.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Acting Secretary*, L. Eardley; *Chairman*, ————; *Directors*, J. A. Lycett, J. V. Kitchener, B. Kingsford.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, A. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager and Engineer*, George Brander; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Chairman*, Wm. Low; *Directors*, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, H. Brown.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, J. Young; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, J.P., Judge L. A. Atherley-Jones, K.C., G. J. Somerville.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, J. S. Moore; *Directors*, A. B. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, T. L. Podmore; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 258, Gravesend.] *Manager*, P. R. Blake; *Sec.*, S. M. Wright; *Chairman*, E. Garcke; *Directors*, W. L. Madgen, P. N. Gray, S. E. Garcke.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, S. J. Rowe; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, P. N. Gray H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, J. B. Collings, Q. Le Pelley, T. W. Palmer.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 99 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Chairman*, G. Kitchin; *Directors*, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, F. H. Withers; *Manager*, F. Freshwater; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, Sir G. Stanley White, Bart.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, A. L. Gardener; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Marquess of Ormonde, J. B. Glenn, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 1220 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, J. Young; *Chairman*, G. J. Somerville; *Directors*, W. Morrison, H. S. Day H. A. Stagg.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond *Secretary*, B. Kingsford; *Chairman*, E. Garcke *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Lord Carmichael, Sir B. Cunard, Bart., H. C. Levis, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, J. R. Holt; *Chairman*, Hon. Sir A. Stanley, G.B.E.; *Directors*, J. M. Henderson, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Corporation Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Liverpool Corporation.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, H. G. Alexander; *Chairman*, H. C. Woodward; *Directors*, H. Sutton Timmis, G. D. Killey, J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Chairman*, A. W. Tait; *Directors*, G. Balfour, Col. A. E. Williams.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, M. A. Edwards, A. H. Beatty.

London and Suburban Traction Company Ltd., Electric Railway House, Broadway, Westminster, London, S.W. *Secretary and Treasurer*, E. Boys; *Assistant Secretary and Treasurer*, A. C. Ingram; *Chairman*, Lord Ashfield; *Deputy-Chairman*, Lord Stuart of Wortley; *Directors*, C. G. Tegetmeier, Sir W. M. Acworth, E. Garcke, E. R. Soames, Sir James Devonshire, K.B.E. (*managing*).

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W.1. [T.N., 6800, Victoria.] *Gen. Manager*, C. J Spencer; *Deputy Manager and Engineer*, A. V. Mason; *Secretary and Treasurer*, E. Boys; *Assistant Secretary and Treasurer*, A. C. Ingram; *Chairman*, Sir W. M. Acworth; *Directors*, George Balfour, M.P., R. H. Montgomery, Sir James Devonshire, K.B.E. C. G. Tegetmeier, H. A. Vernet.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 66, Queen Street, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, William W. Clark.

Mansfield & District Light Railway Co., Sutton Road, Mansfield, and 66, Queen Street, London, E.C. [T.A., Cars, Mansfield, T.N., 107.] *Eng. and Manager*, R. F. Dixon; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, A. D. Foster; *Chairman*, Sir W. H. Vaudrey; *Directors*, Sir B. E. Greenwell, E. Remnant, C. A. Huni.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, F. J. Cursons; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

Metropolitan Electric Tramways, Limited, Electric Railway House, Broadway, Westminster, London, S.W. [T.A., Metrolito, London; T.N., 6800, Victoria.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Gen. Manager*, C. J. Spencer; *Deputy Manager and Engineer*, A. V. Mason; *Secretary and Treasurer*, E. Boys; *Asst. Secretary and Treasurer*, A. C. Ingram; *Chairman*, E. Garcke; *Directors*, Sir William Acworth, Sir James Devonshire, K.B.E., W. L. Madgen, C. G. Tegetmeier.

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 62 and 63, Queen Street, London, E.C. *Manager and Eng.*, W. McGibbon; *Consulting Elec. Eng.*, F. E. Stanley; *Assistant Engineer*, A. A. Davis; *Traffic Supt.*, M. McLeod; *Secretary*, L. D. H. Jacobs; *Chairman*, ——————; *Directors*, W. B. Cownie, C.A. (*Managing*), J. T. Jervis, Ald. D. L. Winter.

Middleton Electric Traction Company, Ltd., Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton: T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, J. S. Bowker; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Musselburgh and District Electric Light and Traction Co., Ltd., High St., Musselburgh, N.B. [T.A., Tramways, Musselburgh; T.N., 115.] (Registered Office, 62 and 63, Queen Street, London, E.C. [T.N., 6616 and 6617, City.]; *Manager*, H. C. Babb; *Assistant Engineer*, E. Simister; *Traffic Supt.*, A. Smith, *Secretary*, L. D. H. Jacobs; *Chairman*, W. B. Cownie; *Directors*, B. Bernheim, J. Anderson, J. T. Jervis.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Secretary*, W. F. Yaxley; *Chairman*, Baron Emile B. d'Erlanger; *Directors*, F. Fitzgerald, C. Pakeman, E. A. Hopkins (*managing*).
[This company controls the Norwich and the Douglas Southern Electric Tramways Companies.]

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, Norwich, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, C. T. Jewell; *Sec.*, W. F. Yaxley; *Directors*, E. A. Hopkins, F. FitzGerald, *Chairman*, Sir G. M. Chamberlin, C. Pakeman, and C. Tomlinson.

Nottinghamshire and Derbyshire Tramways Company, Tramway Depot, Langley Mill, Derbyshire, and 66, Queen Street, London, E.C. [T.A., Tramways, Langley Mill; T.N., 53, Langley Mill.] *Manager*, W. V. Morland; *Secretary*, Wm. C. Bryden; *Directors*, A. R. Holland, A. H. Beatty, W. Shearer, M. A. Edwards, Col. Williams.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Secretary*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, Judge L. A. Atherley Jones, K.C., W. S. Wreathall, J. V. Kitchener (*Managing Director*). (These Tramways have been sold to the local authorities concerned.)

Paisley District Tramways Company, Tramway Depôt, Paisley, and 88, Cannon Street, London, E.C. [T.N., 2938 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Marquis of Ormonde, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., Lincoln Road, Peterborough, and Electrica Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough; T.N., 224.] *Gen. Manager*, A. Anderson; *Secretary*, S. M. Wright; *Chairman*, E. R. Soames; *Directors*, P. N. Gray, J. A. Grant, Lord Vaux of Harrowden.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. [T.N. 53.] *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*).

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Engineer and Manager*, J. Faraday Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 801 & 141.] *Gen. Manager and Eng.*, W. Thom; *Power & Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, B. Kingsford; *Chairman*, R. J. Howley; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and 62 and 63, Queen Street, London, E.C. [T.A., Tramways, Porth; T.N., 118.] *Manager and Engineer*, H. Holliday; *Secretary*, L. D. H. Jacobs; *Chairman*, ——————; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, H. T. Barnett.

Rothesay Tramways Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, A. Robertson; *Engineer*, F. R. Stinson; *Sec.*, S. J. Rowe; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, P. N. Gray.

Ryde Pier Company, Ryde, Isle of Wight. *Secretary*, L. Tayler; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Scarborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, J. V. Moinet; *Chairman*, F. E. Gripper; *Directors*, M. T. Whittaker, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Electricity Works, Sheerness East; T.N., 45.] *Manager & Eng.*, A. Charlton; *Acting Sec.*, F. J. Cursons; *Chairman*, G. J. Somerville; *Director*, E. R. Soames.

South Metropolitan Electric Tramways and Lighting Company, Ltd., Electric Railway House, Broadway, Westminster, London, S.W.1, 114, Church Street, Croydon, and 30, High Street, Sutton. [T.N., 6800 Victoria, 1304 Croydon, and 14 Sutton.] *Gen. Manager*, C. J. Spencer; *Deputy Manager and Engineer*, A. V. Mason; *Secretary and Treasurer*, E. Boys; *Asst. Secretary and Treasurer*. A. C. Ingram; *Chairman*, C. G. Tegetmeier; *Directors*, Sir James Devonshire, K.B.E., E. Garcke.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, A. T. Faiers; *Chairman*, A. Skinner; *Directors*, J. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

South Staffordshire Tramways (Lessee) Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Acting Secretary*, L. Eardley; *Chairman*, W. S. Schuster; *Directors*, J. A. Lycett, B. Kingsford, J. V. Kitchener.

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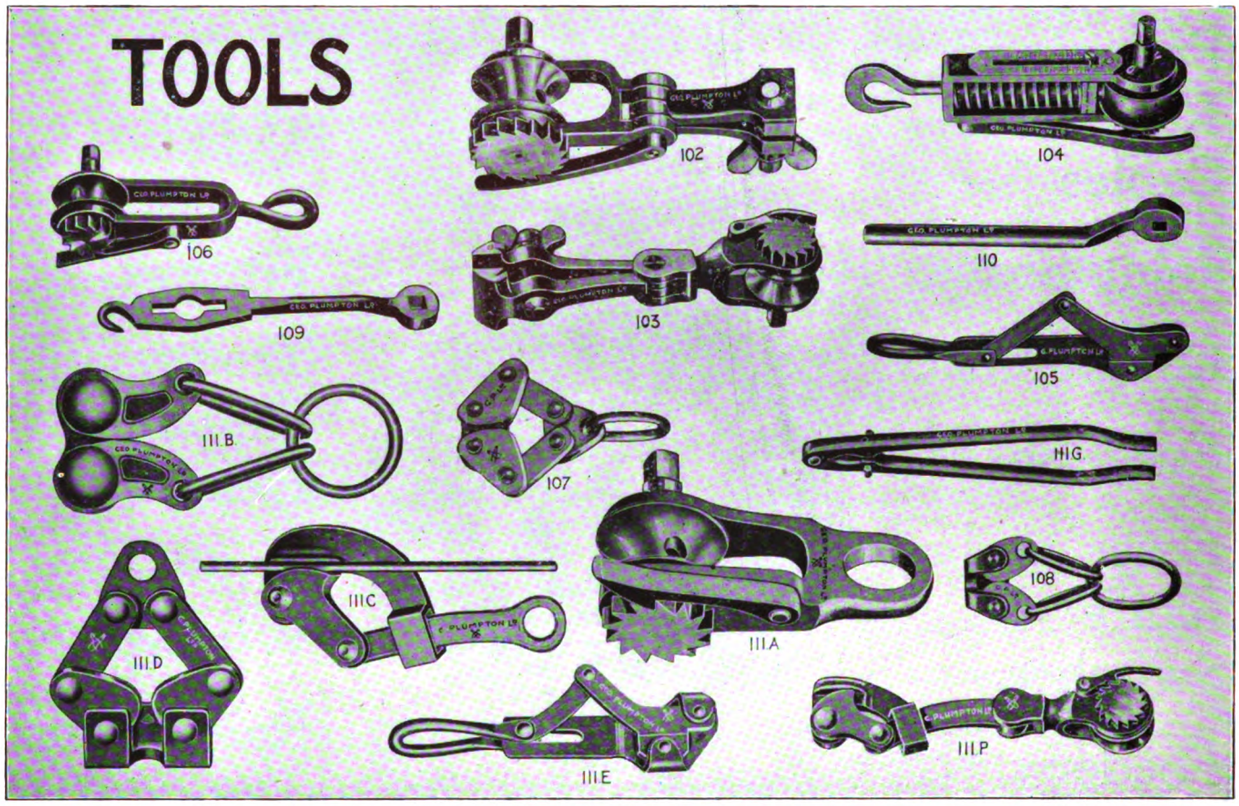

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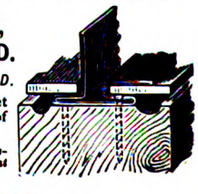

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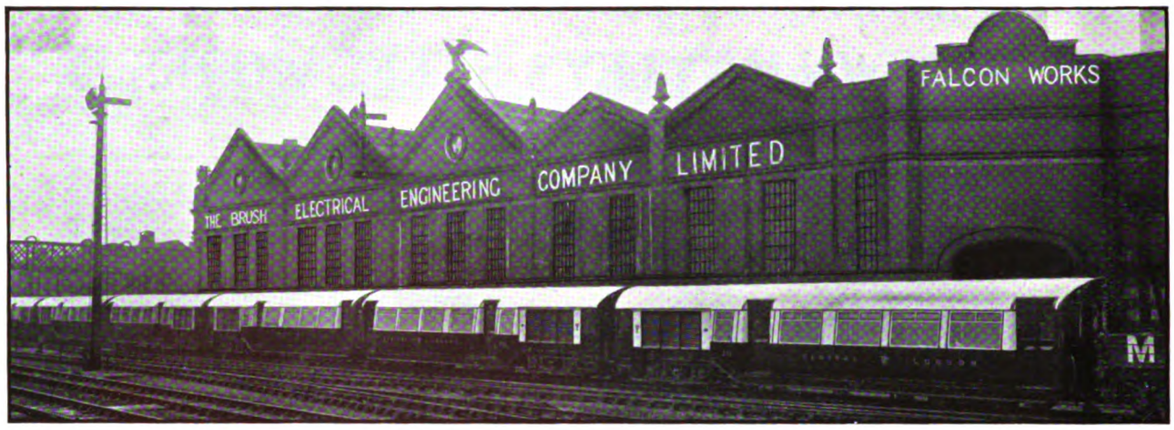

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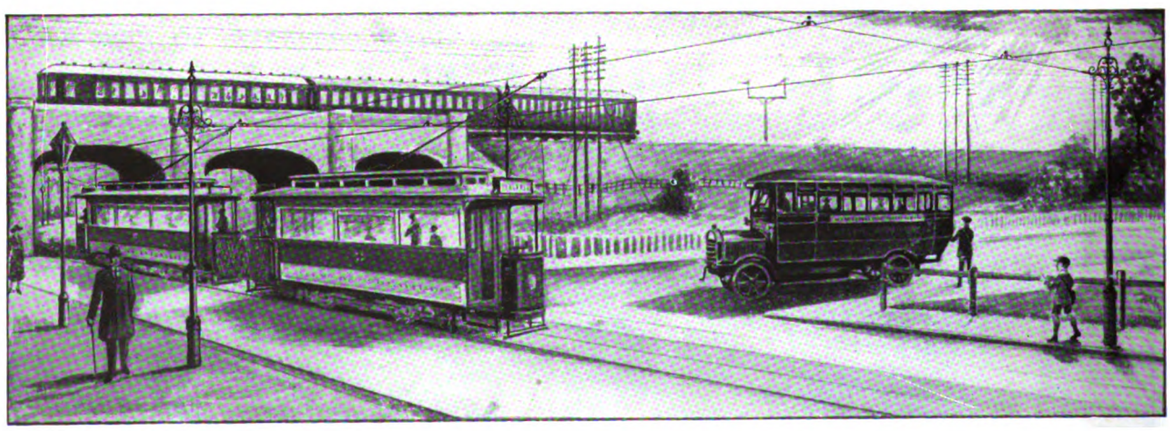

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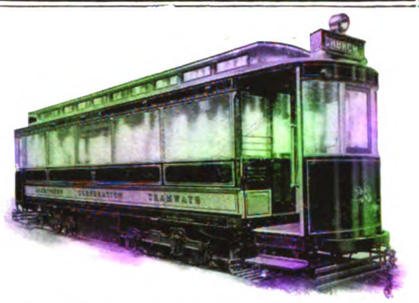

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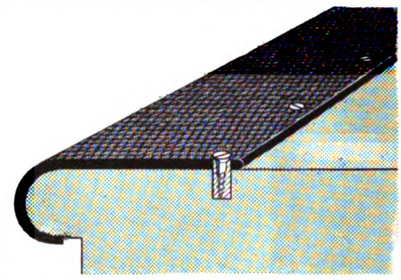

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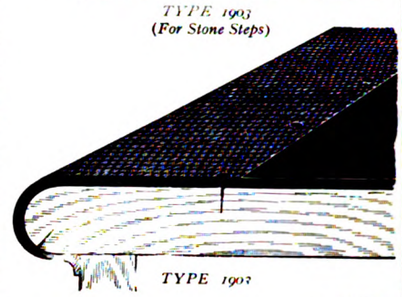

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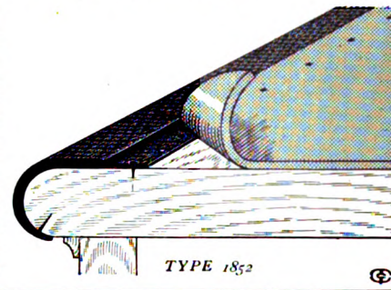

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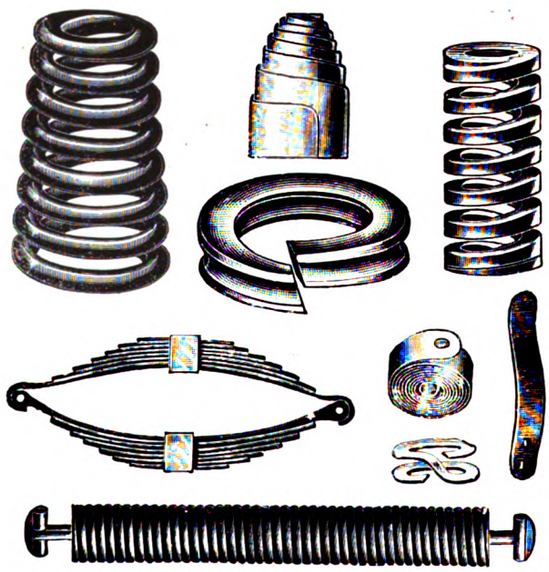

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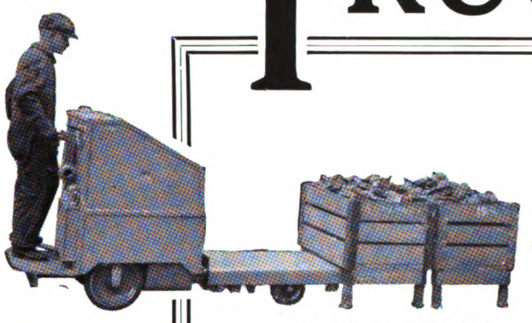

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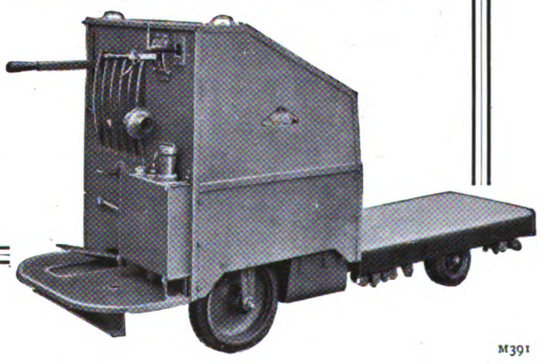

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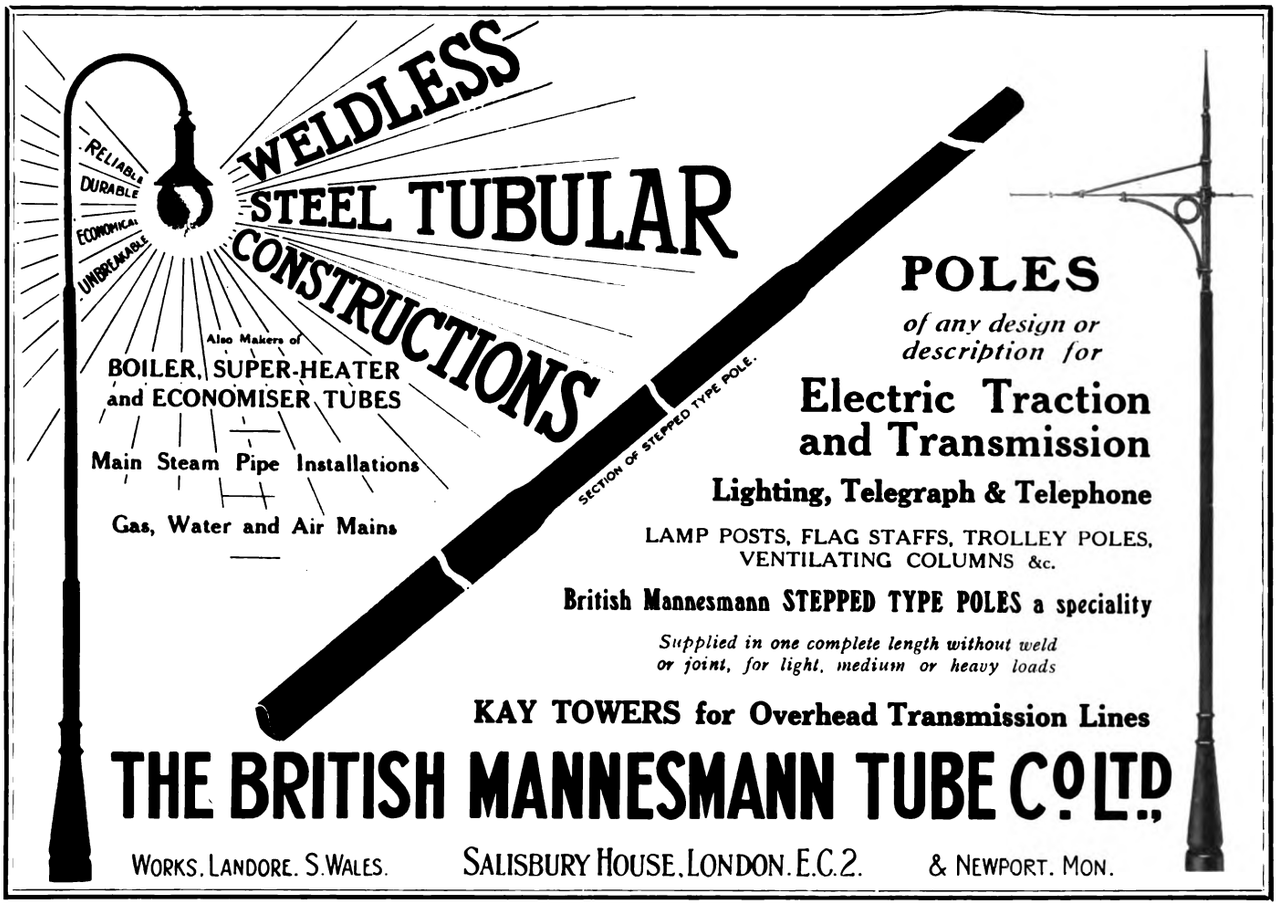

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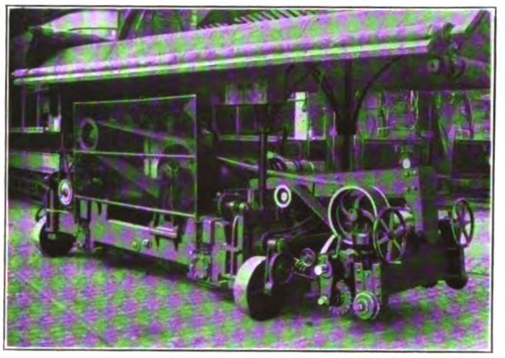

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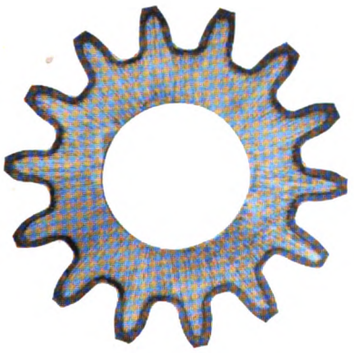

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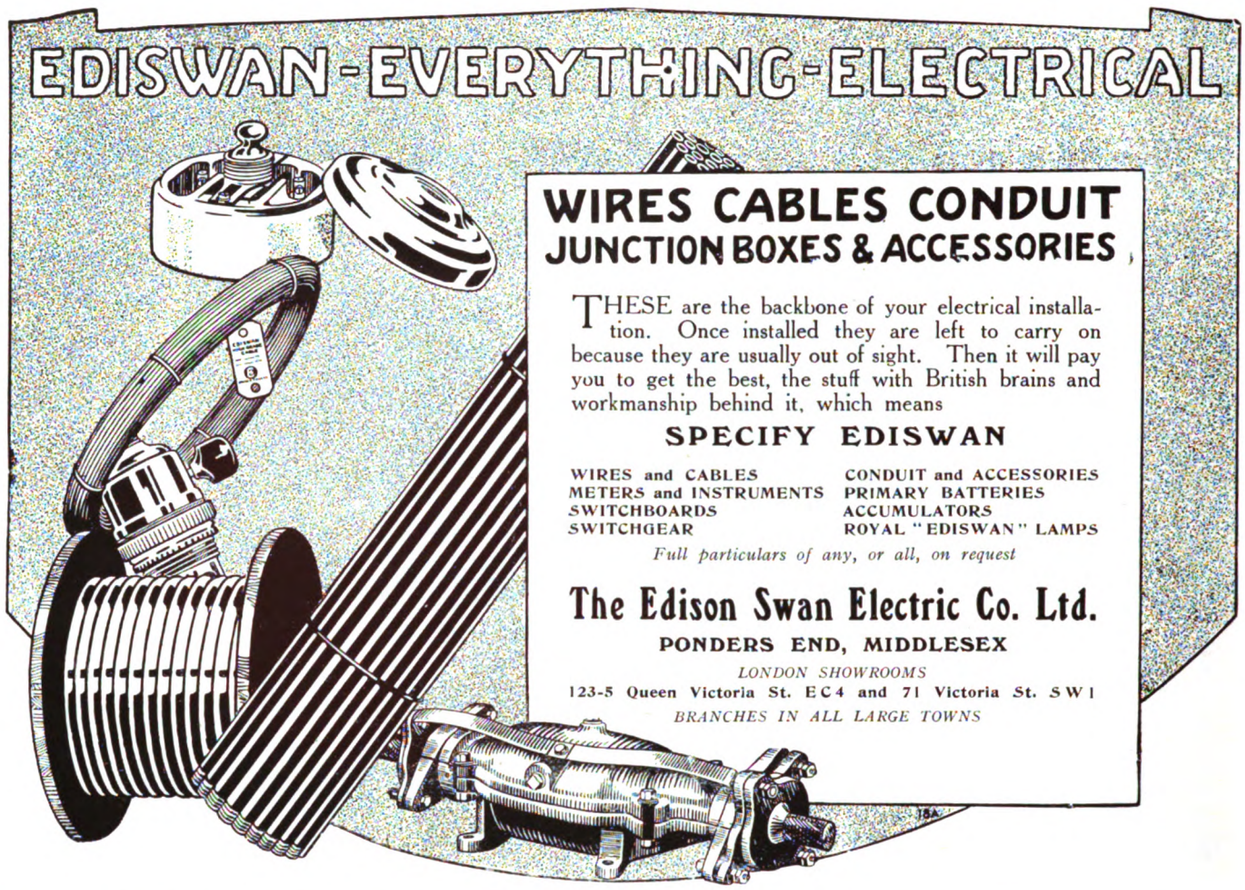

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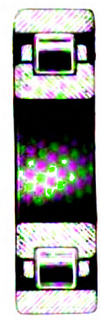

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THE PIONEERS OF

RAILLESS ELECTRIC TRACTION

PRODUCE THE EASIEST RIDING
AND
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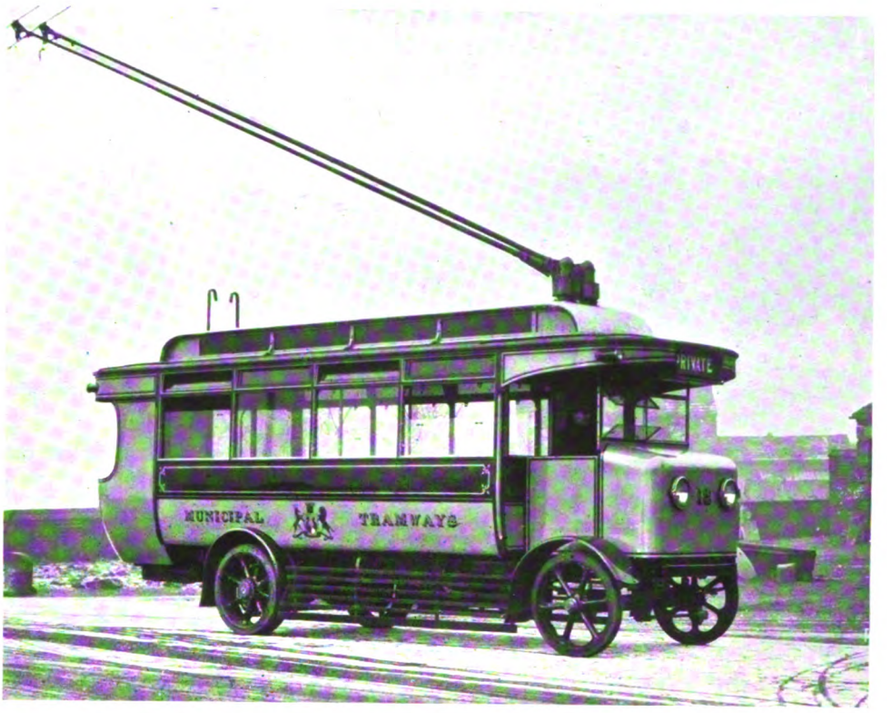

CAPABLE OF HIGH AVERAGE SPEED, MAINTAINING PERFECT CONTACT WITH TROLLEY WIRES UNDER SEVEREST DEVIATIONS WITH A PATENTED COMPENSATING TROLLEY.

IT IS PERFECTLY BALANCED IN ALL ITS MOVEMENTS,
IT HAS HIGH INSULATION RESISTANCE IN ALL WEATHERS,
AND WITH EASY CABLE LEADS FULLY PROTECTED,
MAINTENANCE IS PRACTICALLY *NIL*.

Silent Single and Double-Deck Cars up to 60 Seats with Complete Overhead Line Installations and Power Plant Supplied, Installed and Service Started Up.

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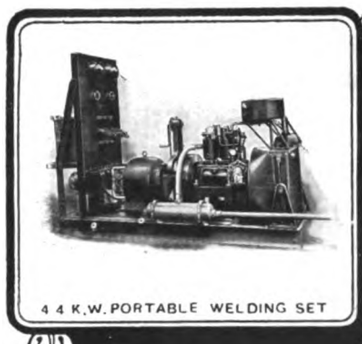
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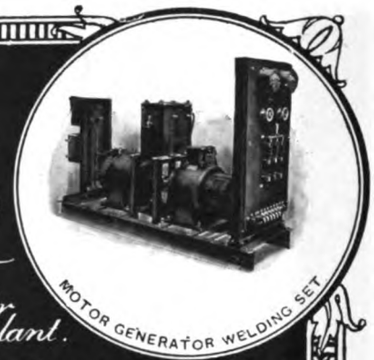
THE "PREMIER"
4·4 K.W. PATENTED
WELDING GENERATOR
supplies the correct current for any given job and offers many other ADVANTAGES
Gives perfect results for both light and heavy work.—Owing to small size and light weight is admirably suited for portable and mobile welding plant.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The PREMIER ELECTRIC WELDING COMPANY LTD.
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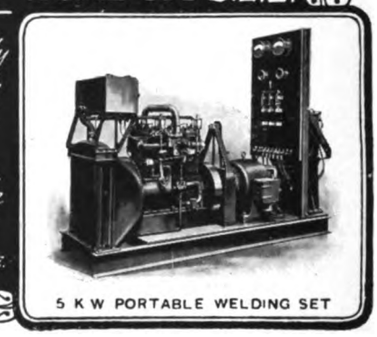
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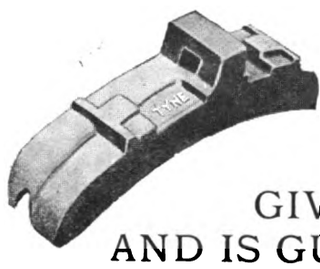
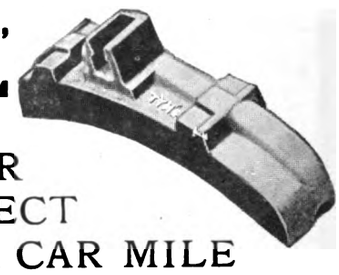


"TYNE METAL"



IT RESISTS HEAVY WEAR
GIVES GOOD BRAKING EFFECT
AND IS GUARANTEED CHEAPEST PER CAR MILE

TYNE METAL CO. Ltd.
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Telegrams "TICKETS, GLASGOW"

If you ask that question of the managers of the largest tramway undertakings, both at home and abroad, the answer will be—
"Yes, we use Glasgow Tickets."

May we send you some specimens? We produce tickets in any style, in any quantity, and print in any language.

Whenever you want tickets, either paper or pulp, we shall be pleased to quote you.

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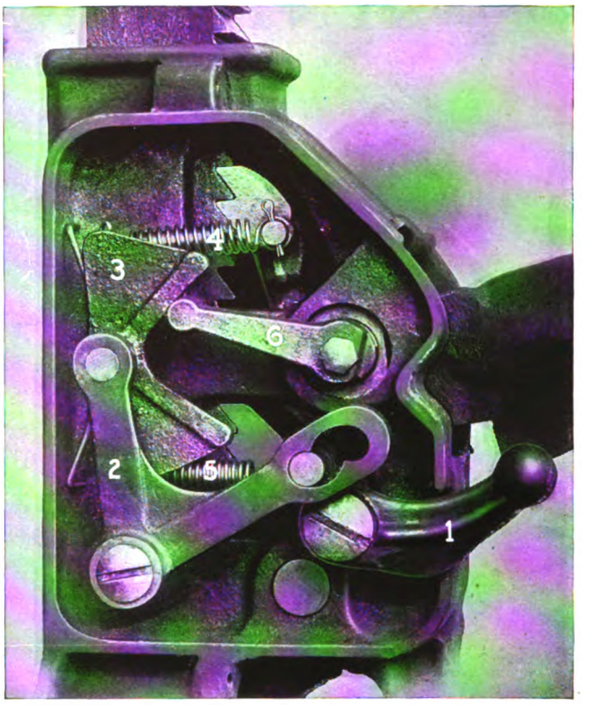
Three Apostles of Force—

The most powerful ratchet lever type of jacks ever designed for car repair work, bridge builders and general lifting purposes. All of 15 tons capacity, they differ only in height, which is 22 in., 28 in., and 35 in. respectively.

Note the greatly simplified operating mechanism, eliminating a great number of small parts found in similar types, and making these jacks unequalled in their class for positive operation, easy lift, and low repair cost.



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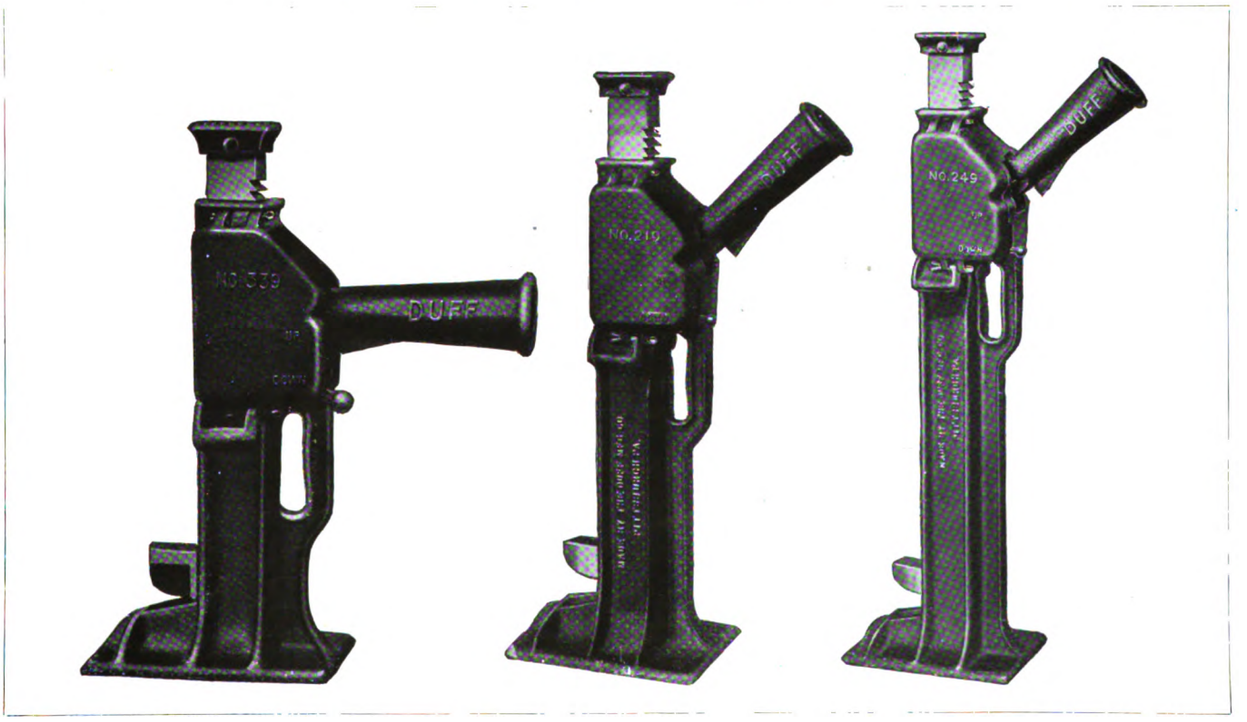

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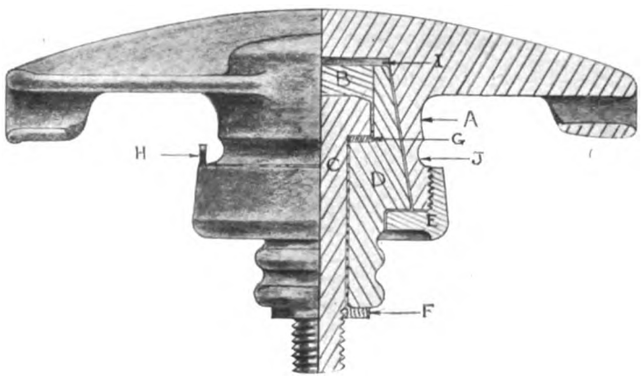

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All Bolts are Interchangeable and screwed $\frac{5}{8}$in. or $\frac{3}{4}$in. Whitworth.

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Improper phantom indications impossible.

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For Alternating or Direct Current
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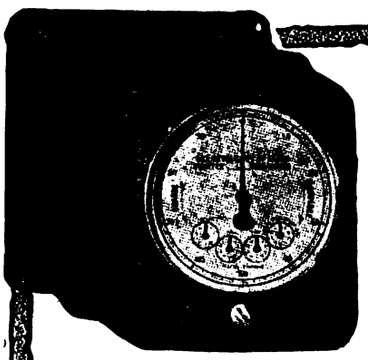
Branches throughout the United Kingdom and in all the Principal Markets of the World



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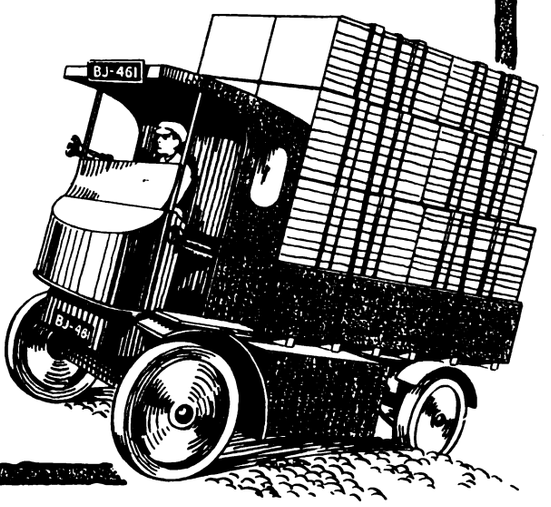

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Telephone Service is peculiar—BLUE BELLS are peculiarly fitted for it.

YOU would pick a thoroughbred for the running race—a horse that is built and trained for the race. You would follow the universal judgment of other racing men the world over.

There are more thoroughbreds used in horse racing than heavy draught horses.

As in selecting race horses, why not select for telephone service a battery designed and built for that work? By doing so, you will follow the example of the majority of telephone companies.

There are more Blue Bells used for Telephone Service than General Utility Batteries.

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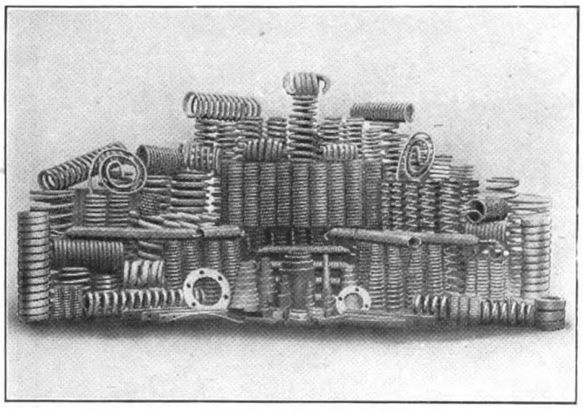
BLUE BELL BATTERIES

are the thoroughbreds to pick for telephone service. **Medium Amperage** and **Low Shelf Wear Rate** combine to give the **BLUE BELL** a long and useful life that cannot be obtained with commercial general utility batteries.



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The Power Cost of this Trolley-Bus

is 1d. per Bus Mile

This vehicle has established

AN ELECTRIC TRACTION RECORD

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	Average Per Bus Mile	
Receipts	19·54	pence
Operating Costs	12·11	„
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The average fare is only ·87 pence per Bus Mile.

Compare the above with your own Tramway, Petrol, or Trolley Omnibus Results.

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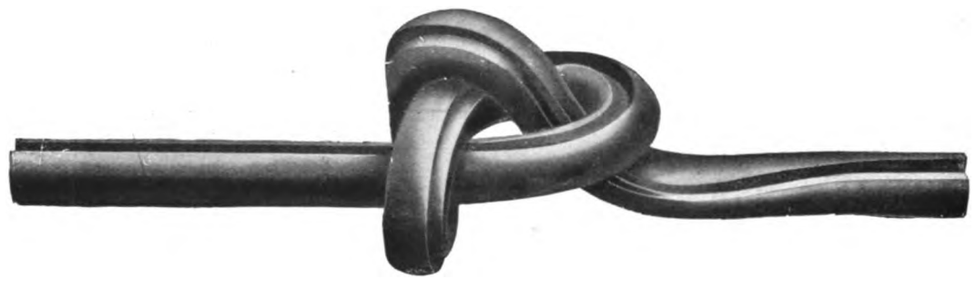
OR ARE YOU GIVING IT YOUR CONSIDERATION?

THE FIRST COST IS THE LAST!



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THE LIFE OF PHONO-ELECTRIC IS AT LEAST THREE TIMES THAT OF HARD-DRAWN COPPER TROLLEY WIRE

ERECT A TRIAL LENGTH ON THE MOST DIFFICULT PORTION OF YOUR SYSTEM.

PROVE FOR YOURSELF ITS WONDERFUL WEARING QUALITIES AND CAPABILITY TO SUCCESSFULLY WITHSTAND THE WORST KIND OF SERVICE CONDITIONS.

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ENTIRELY BRITISH MANUFACTURE

There is a prevailing impression that Ackley Brakes are of Foreign manufacture. This is incorrect. Ackley Brakes sold in this country are British made and always have been.

ACKLEY BRAKES ARE A STANDARDISED PRODUCT PRODUCED UNDER ORGANISED CONDITIONS, AND HAVE STOOD THE TEST OF TIME. THEY ARE MADE IN SEVERAL TYPES WITH AND WITHOUT STOPS. WE HAVE THE DESIGN TO MEET YOUR PARTICULAR NEEDS. YOU ARE OUT OF DATE UNLESS YOU USE ACKLEY BRAKES.

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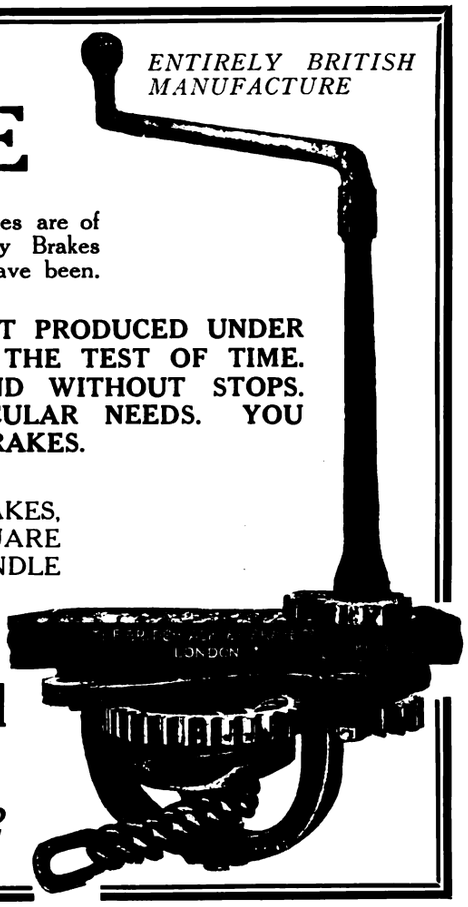

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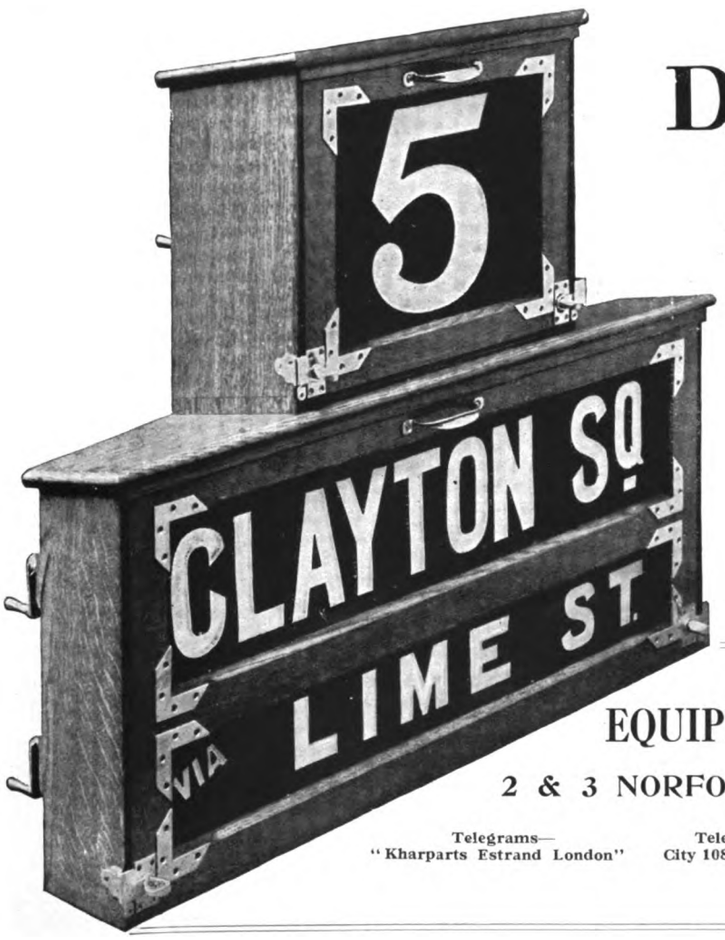

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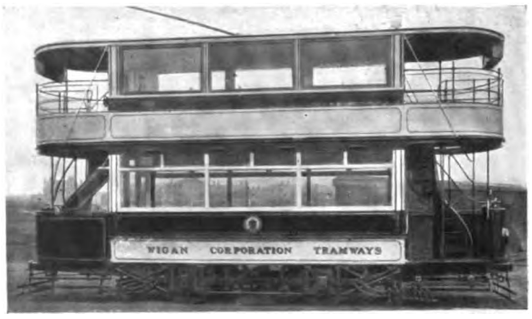

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1/3, 2/6, 5/- each plated.

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We have keen prices for quantity quotations.

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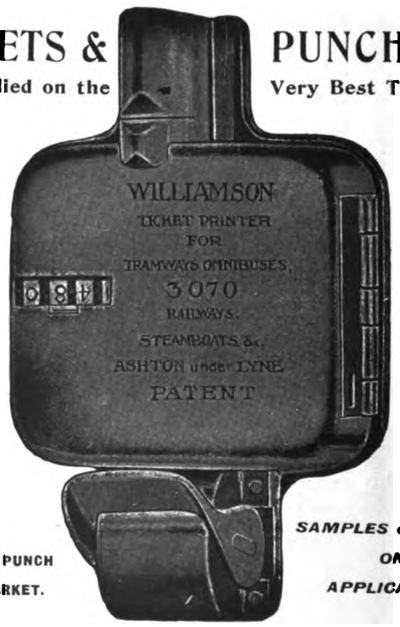

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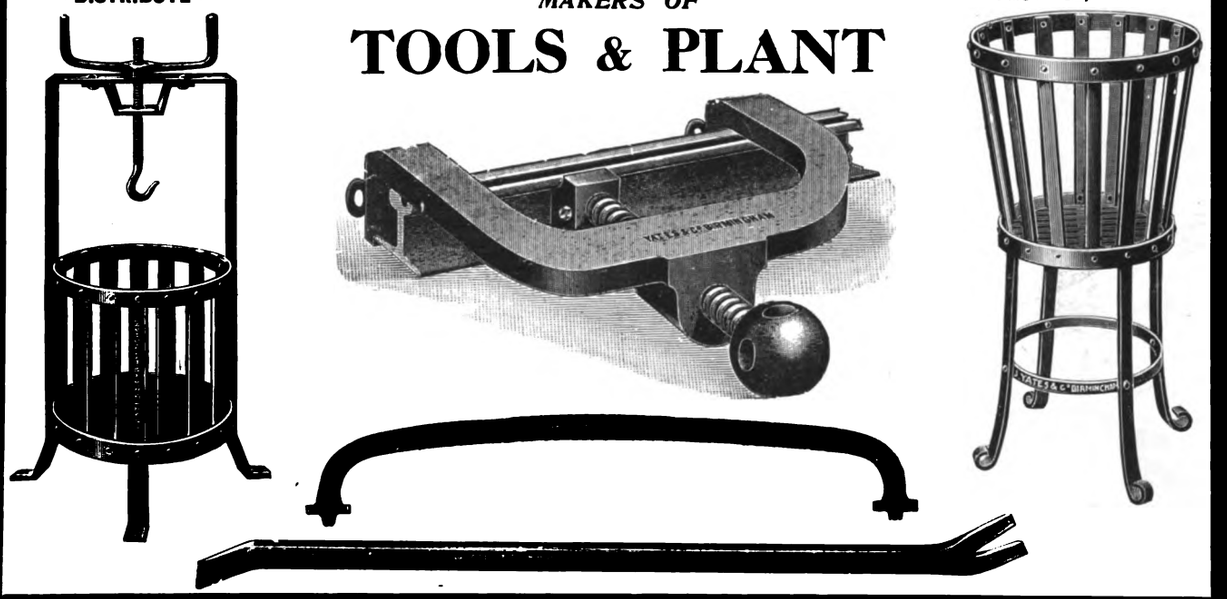

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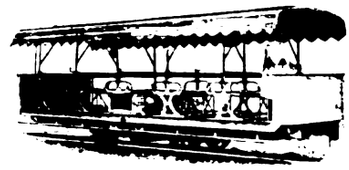
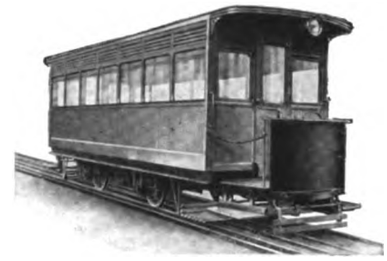
Simplex Cars have no Unsprung Axle Weights





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N.K.A. BEARINGS have *proved* their merits as the ideal bearing for heavy loads. The very nature of their distinctive design makes them the most suitable for this type of work. The perfection and accuracy of their construction is a triumph of engineering, and ensures service efficiency under the most strenuous conditions.

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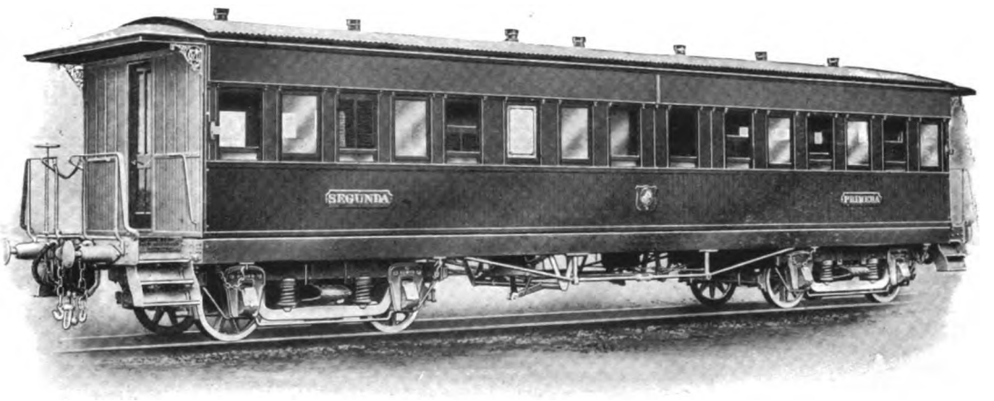

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as built for the Midland Uruguay Railway Company Limited.

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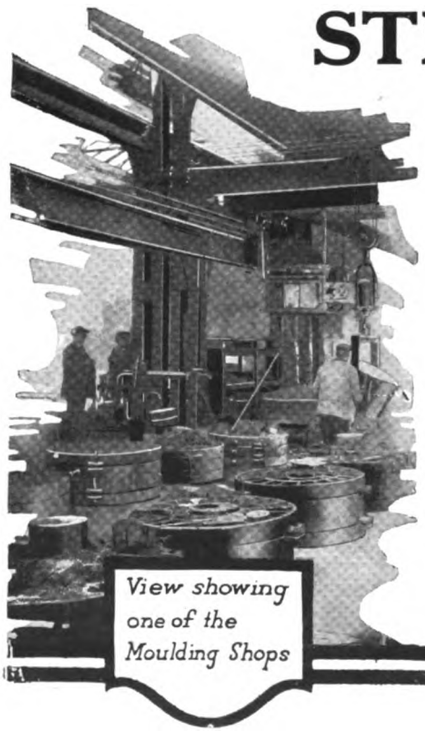

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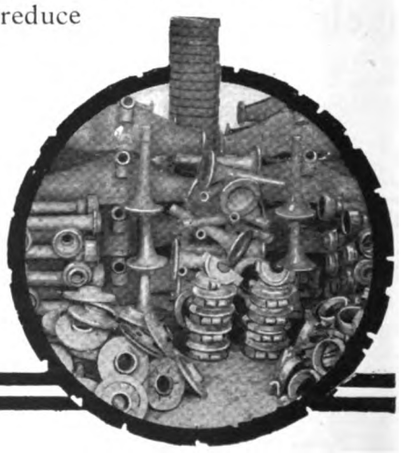

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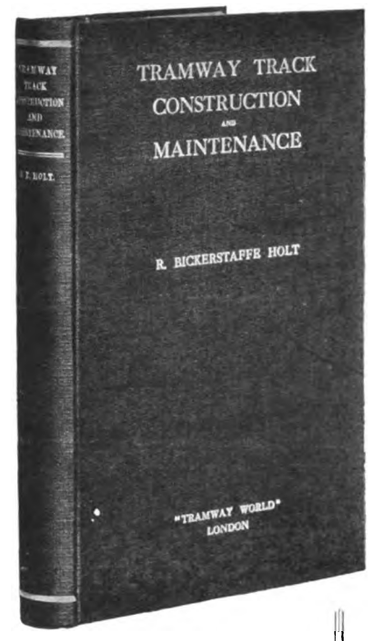

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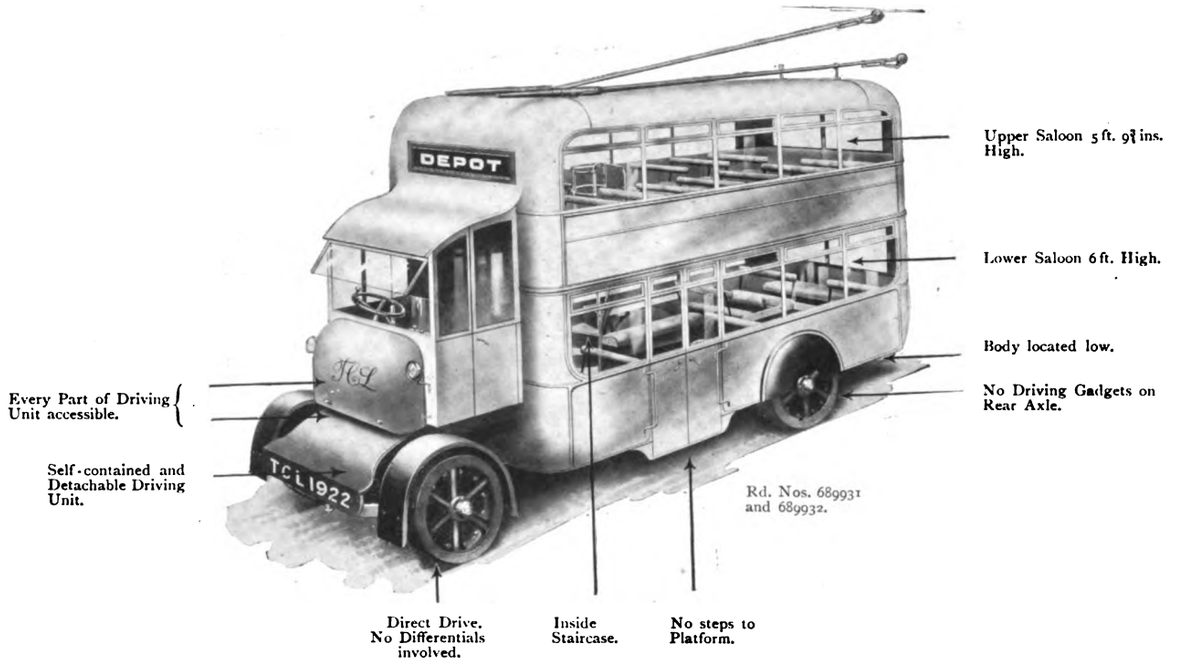

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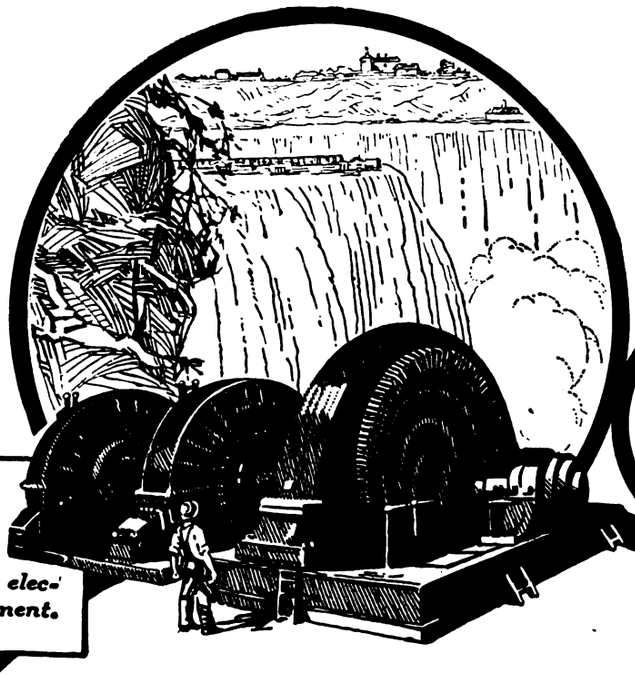

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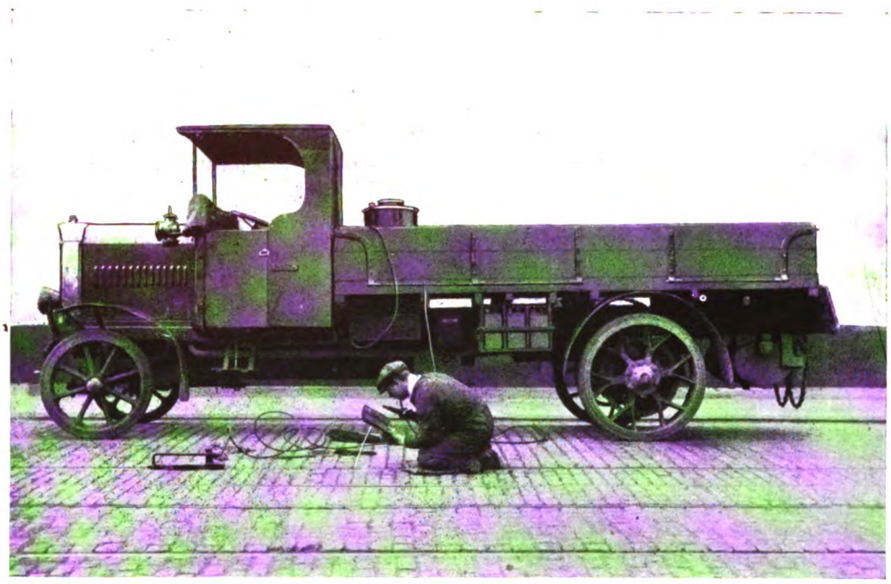

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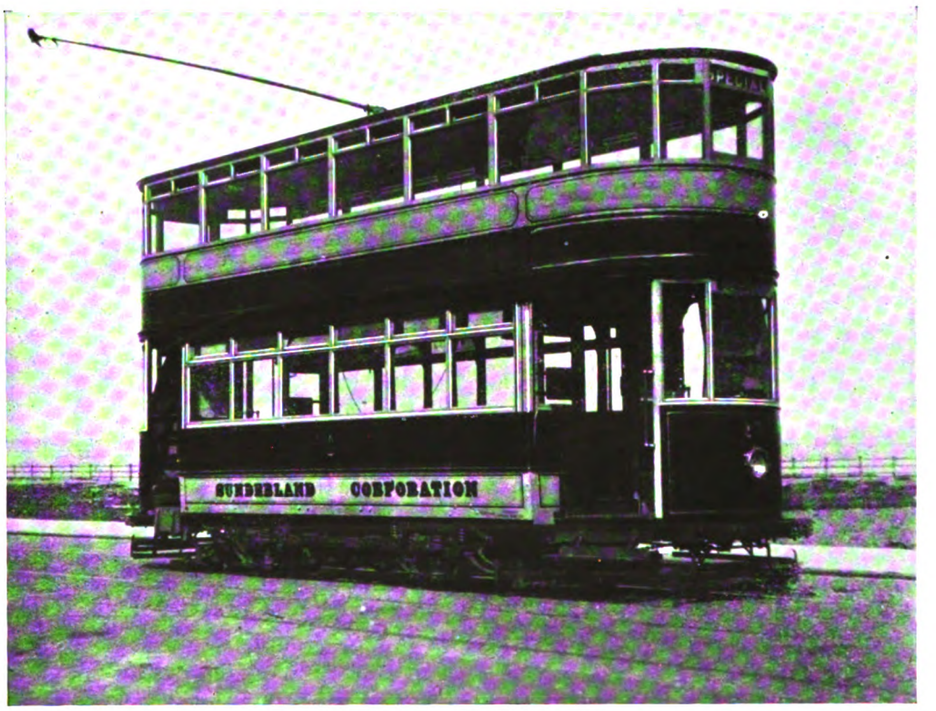

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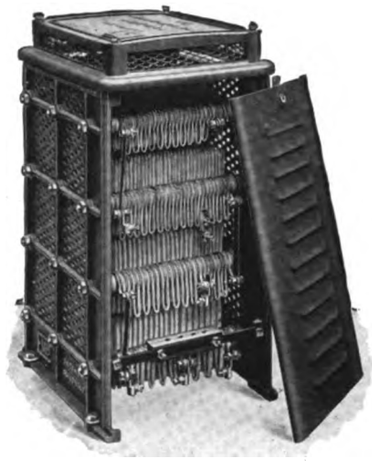

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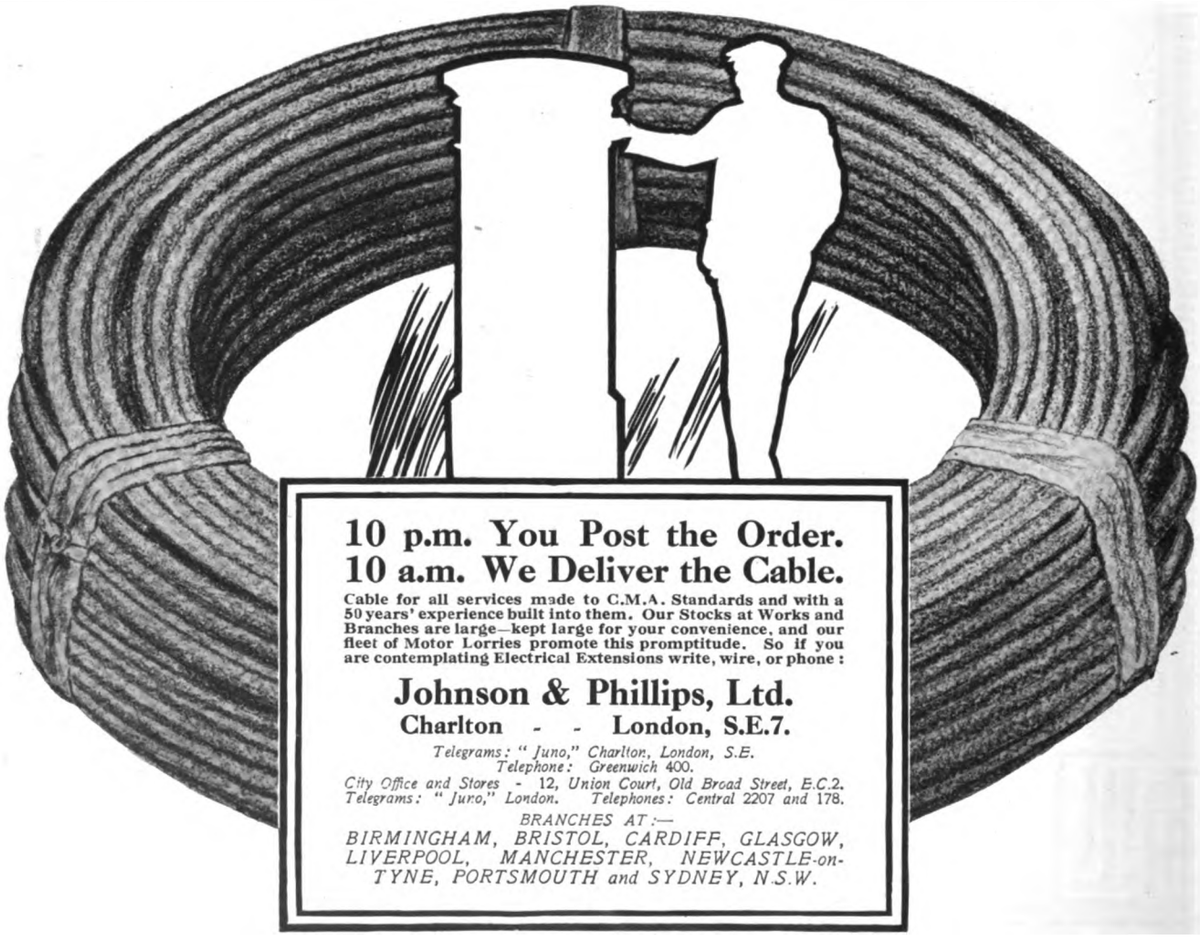

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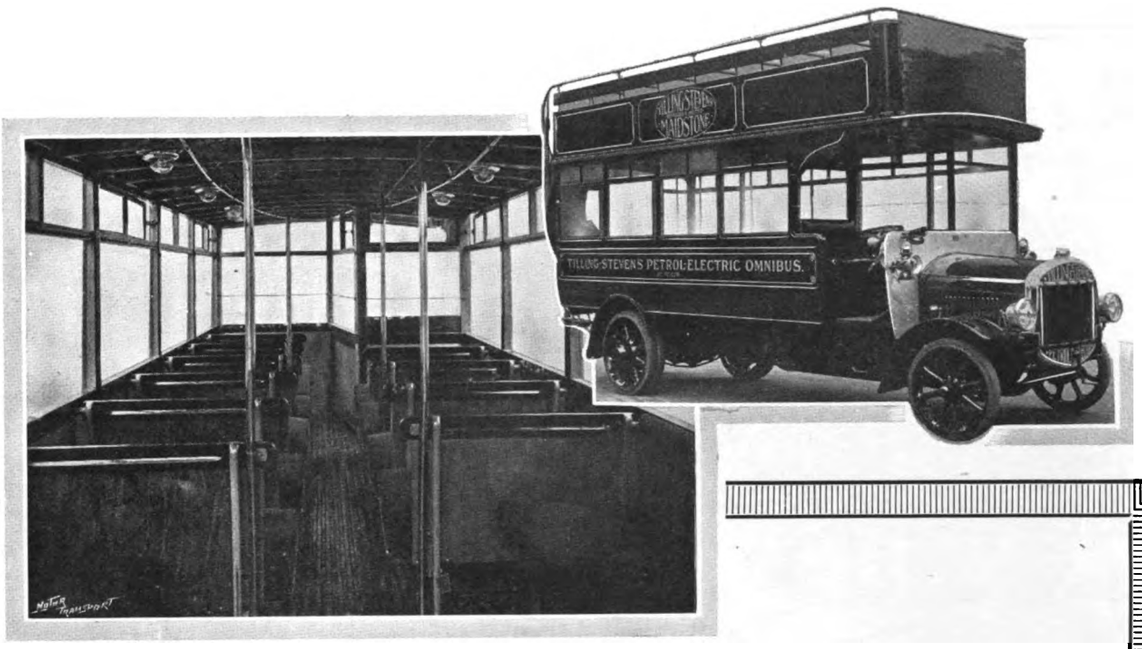

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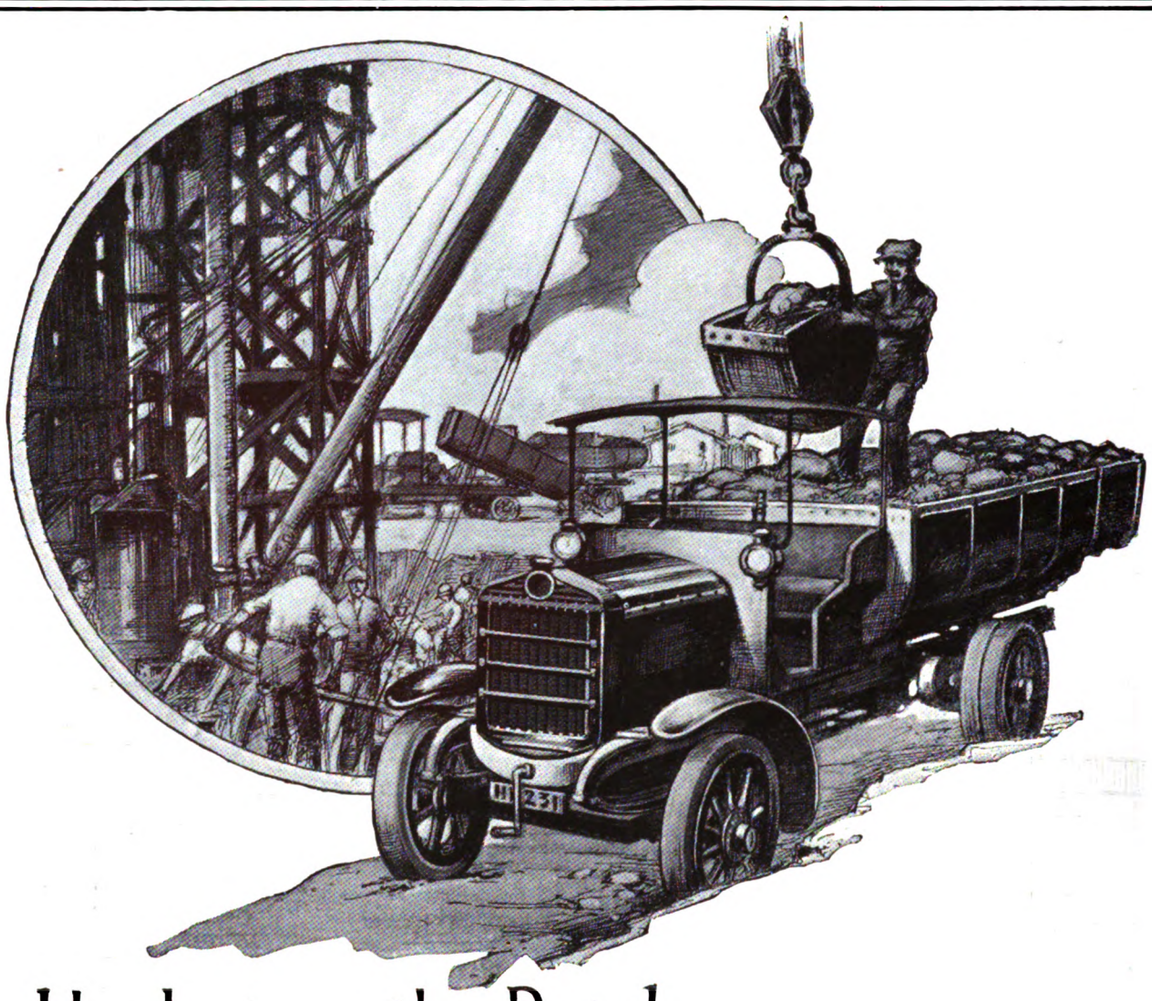

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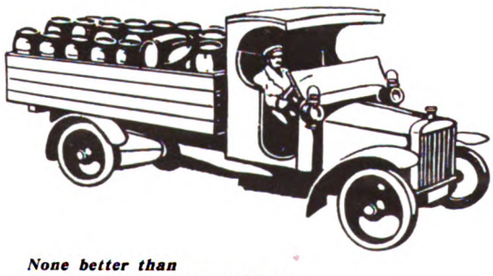

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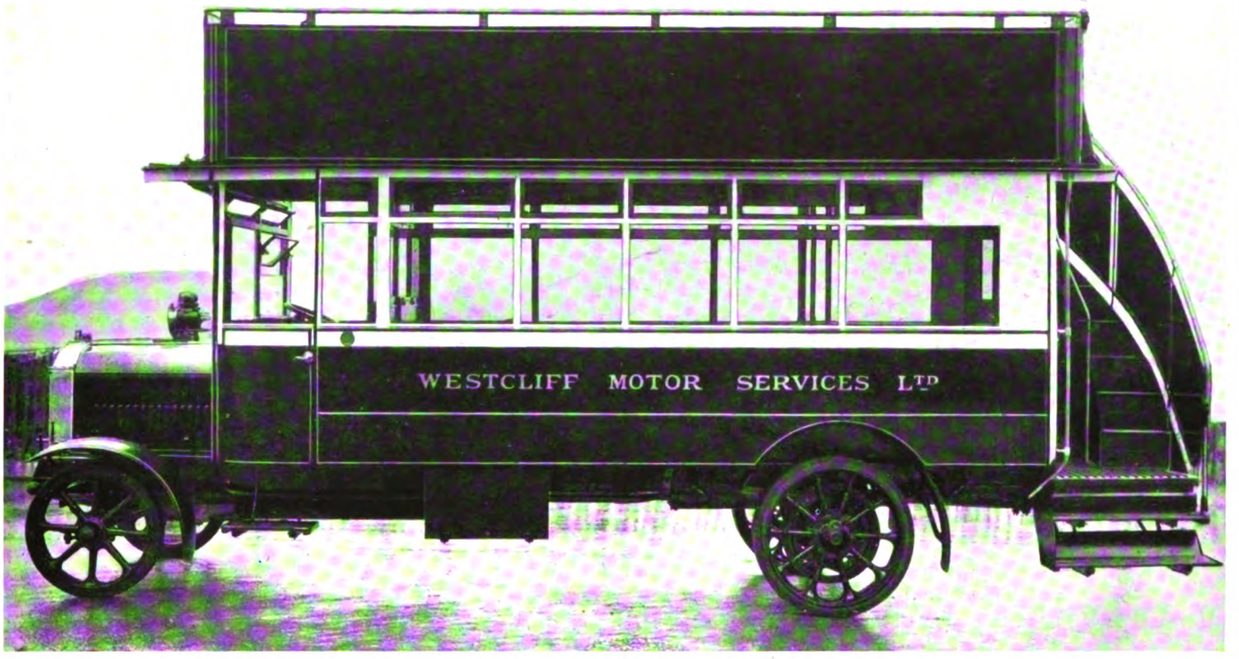

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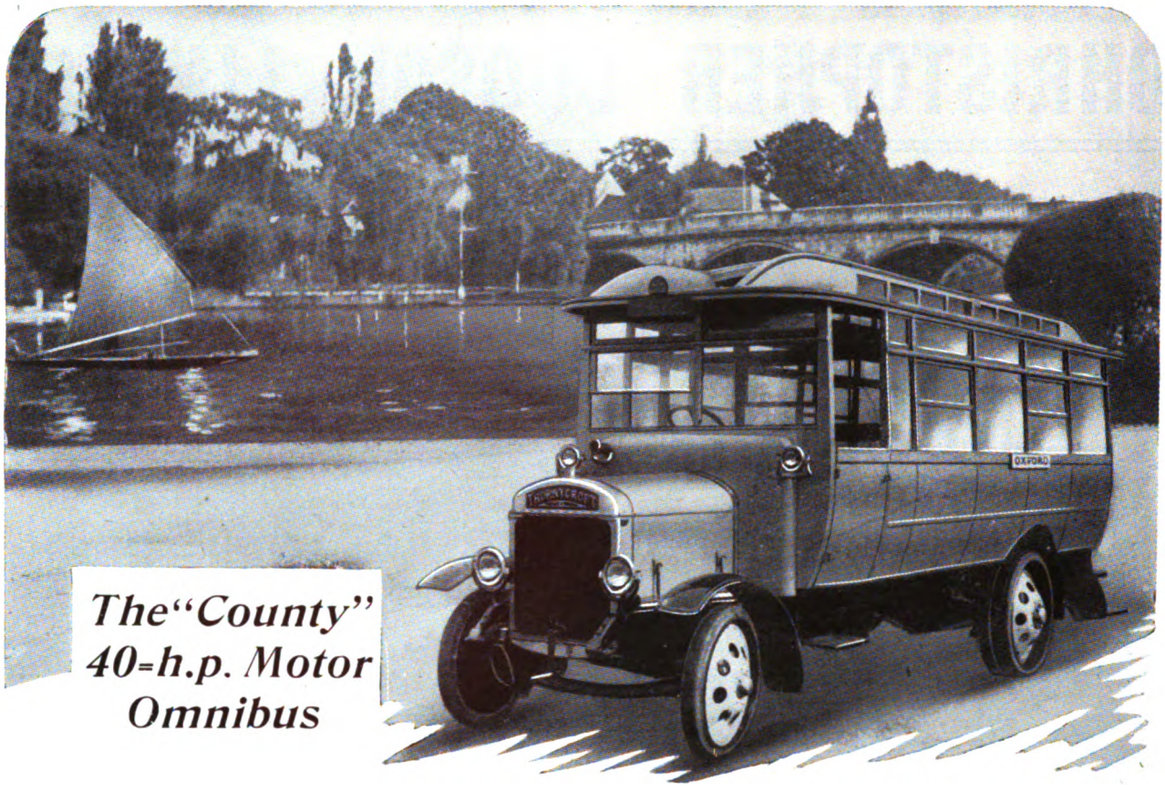

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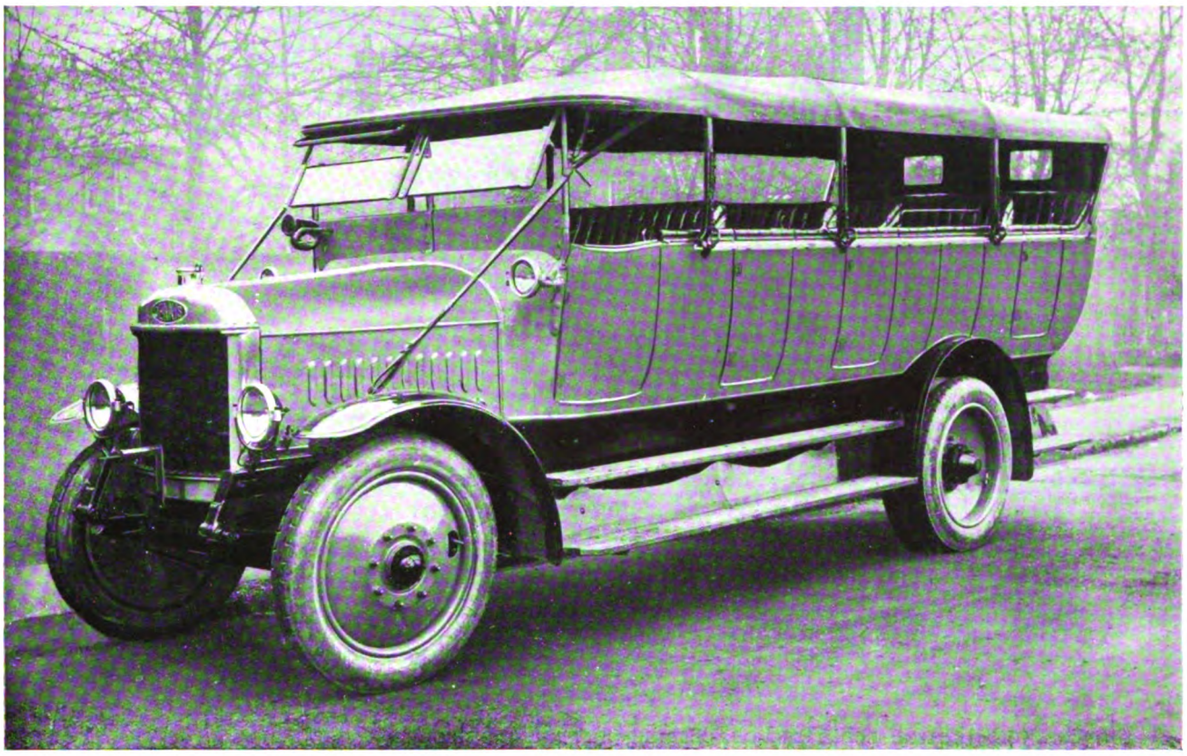

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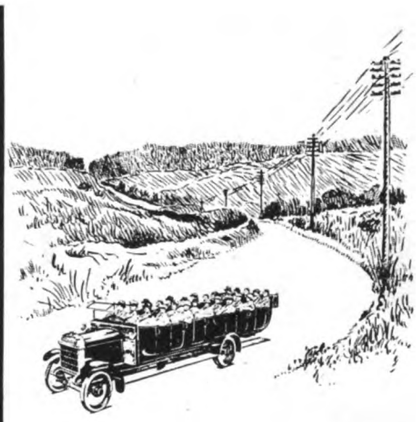

are built for every phase of modern transport and to undertake the heaviest loads with running and maintenance costs which are so low as to be unrivalled.

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IN 1915 the Nottingham Corporation put into service one of our Electric Tipping Wagons. In 1916 two more were acquired; in 1917 a further four were put into use and so on. Other makes were then adopted and now to-day this Corporation has 20 of our Accumulator Electrics, having just placed a repeat order for three more, thus endorsing the experience of the Islington Borough Council and over fifty other Corporations etc.

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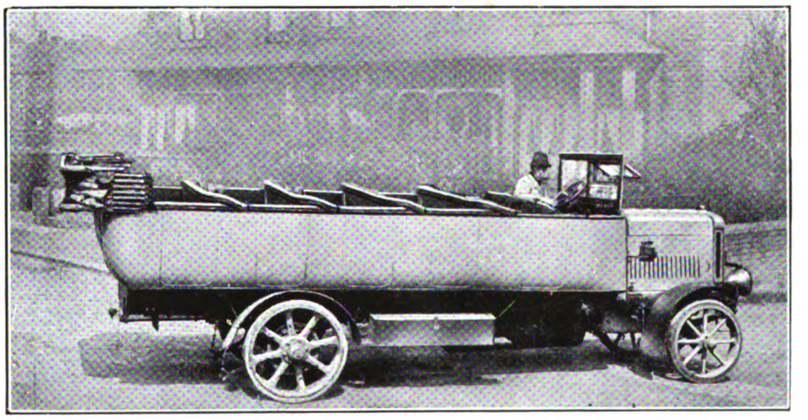
—"NOT EVEN A SERIOUS RIVAL"

An Interesting Letter from Mr. R. A. Bonner of Stanningley dated February 20th, 1922

"IN November last we carried a Tar Still from Stanningley to East India Docks, London, which weighed 5 tons 16 cwts., 11 ft. 4 ins. diameter and 14 ft. high. This necessitated removing the body and making two cradles. However, we may say that no trouble whatever was met with; the total journey being 400 miles, which my driver accomplished in four days, which we think is an exceptional performance. This identical machine has been used as a 30-seater Char-a-bancs during the past two years, and as a lorry in the winter. The only expenditure on same has been a new bonnet; this of course only for appearances sake. There is nothing on the road in the Char-a-bancs line that can come near us for pulling and all-round efficiency, and in conclusion we can say that in future all our lorries for our own use will be LEYLANDS—***which we consider have not even a serious rival.***"

"Leyland Lorries for Loads"



This is the Vehicle to which Mr. Bonner refers. It is interchangeable as a Lorry for work during the winter, and as a Char-a-bancs during summer

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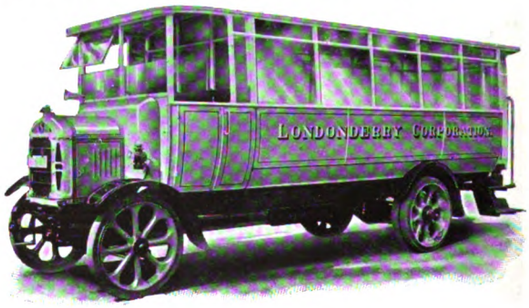

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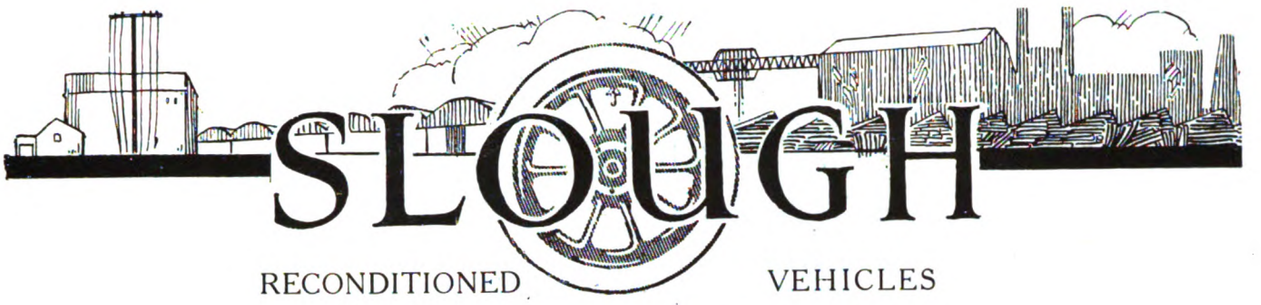

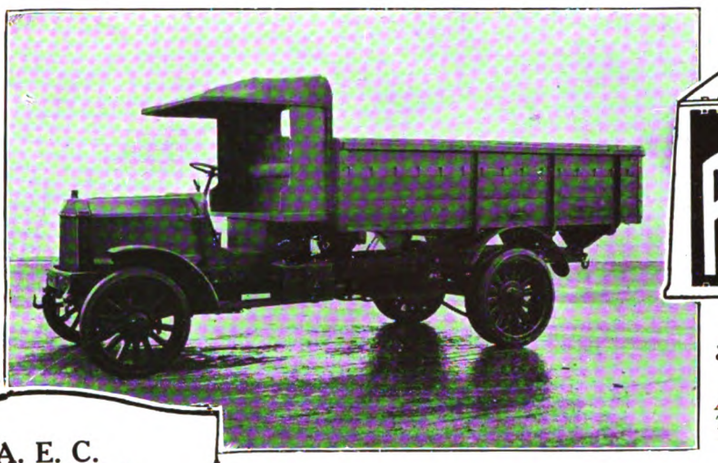

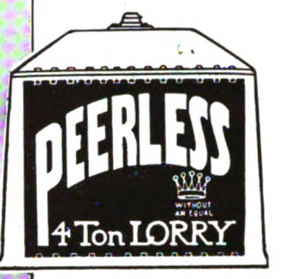

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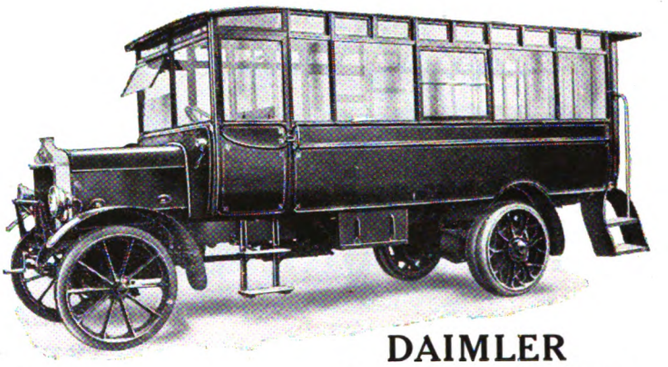

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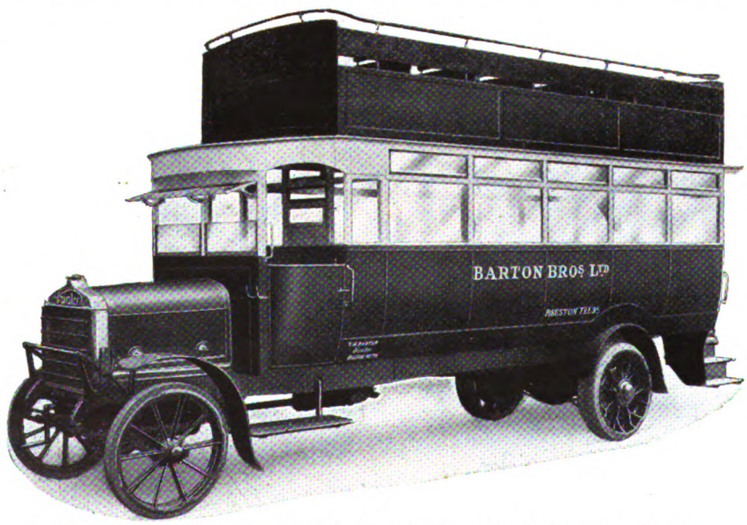

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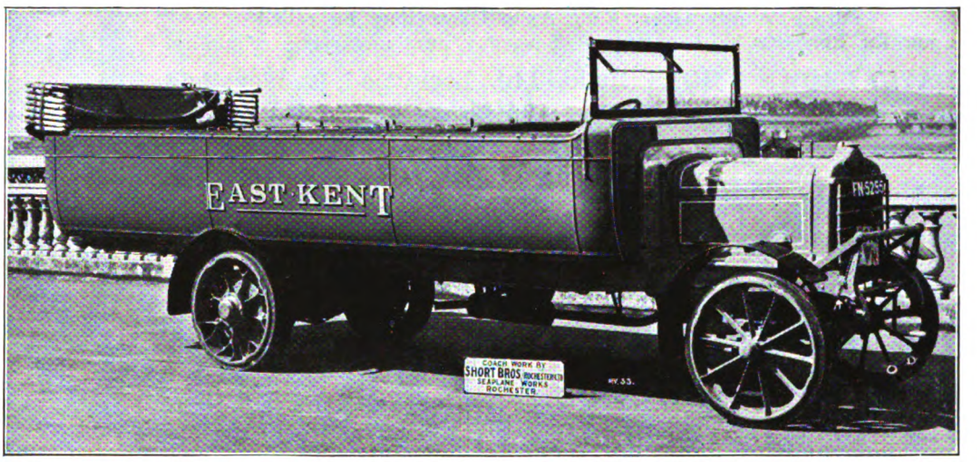

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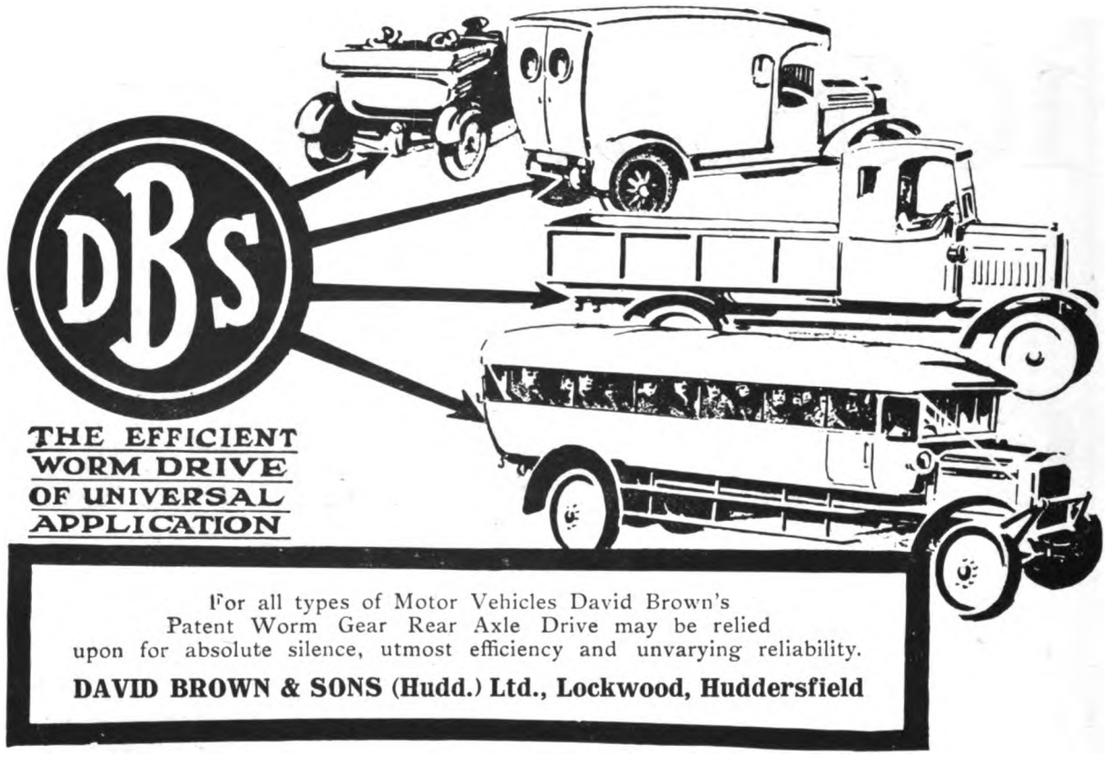

THE AUTOBUS

IN THE TRAMWAY WORLD.

Motor Traffic Section.

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In pursuance of that policy the progress of motor traction received early attention. Commenting on the historic motor parade to Brighton in 1896, "The Tramway and Railway World" predicted that

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was added. Every illustrated issue thus contains a section devoted especially to motor cars for Public Service, and includes articles on current topics, illustrated descriptions of new types of vehicles and accessories, and the latest news.

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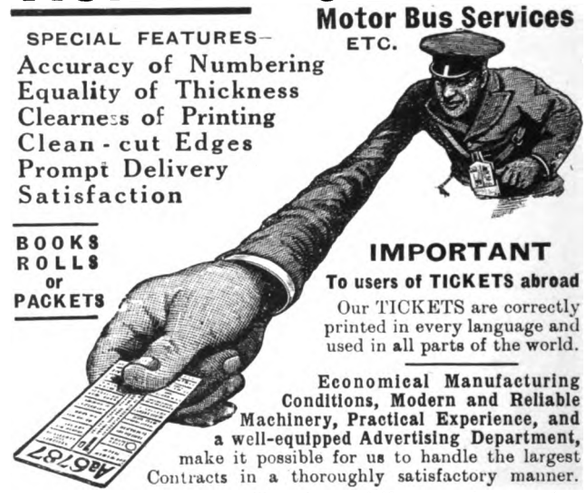

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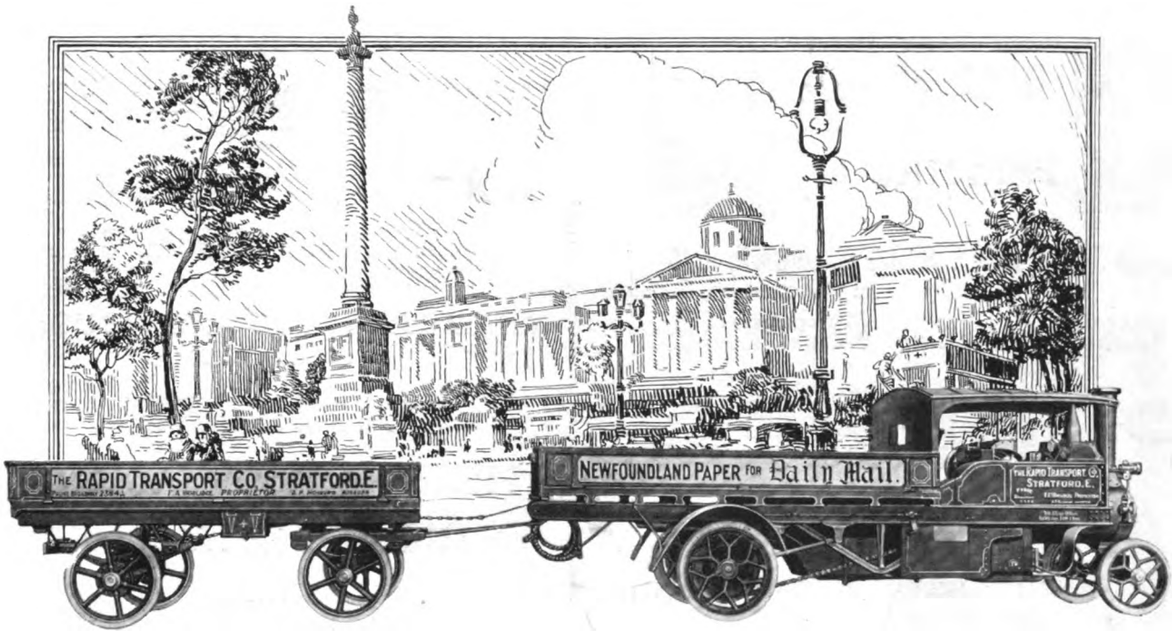

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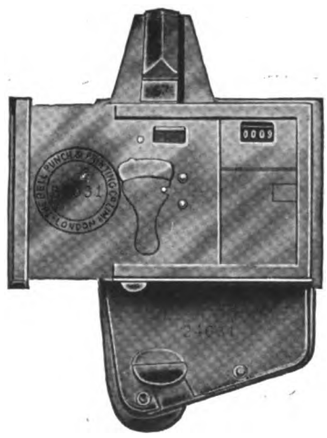

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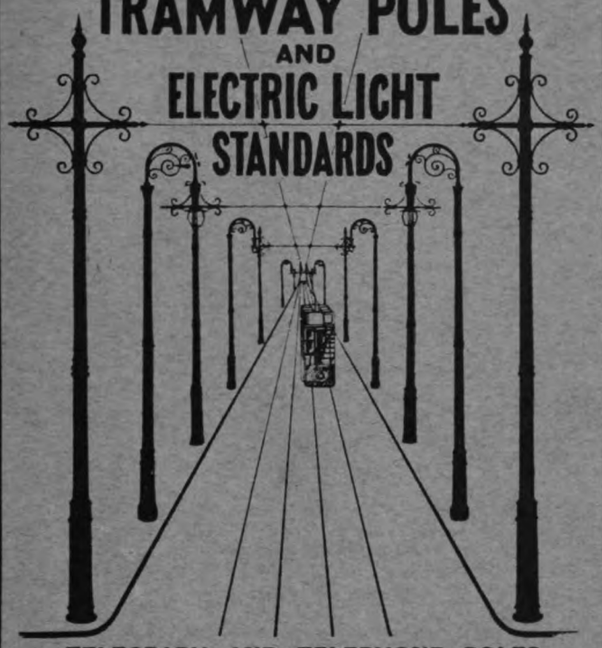

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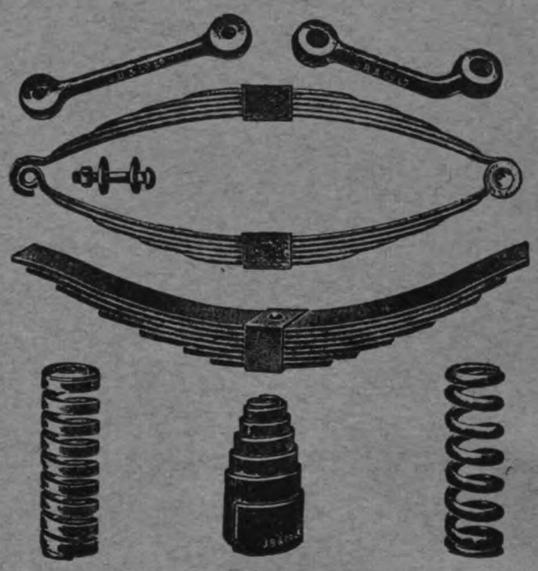

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